GEOLOGICAL SURVEY OF CANADA
PAPER 89-7

GEOLOGICAL SURVEY OF CANADA RADIOCARBON DATES XXIX

Collated by

R. McNeely and S. McCuaig

1991

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Authors' address

R. McNeely
S. McCuaig
Geological Survey of Canada
Terrain Sciences Division
601 Booth Street
Ottawa, Ontario
K1A 0E8

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3 2. Monthly average count rate for oxalic acid standards and the number of individual counts (N) made during the period December 1988 through December 1989.

This Date List, GSC XXIX, is the eighteenth to be published directly in the Geological Survey's Paper series. Lists prior to GSC XII were published first in the journal Radiocarbon and were reprinted as GSC Papers. The lists through 1967 (GSC VI) were given new pagination, whereas lists VII to XI (1968 to 1971) were reprinted with the same pagination.

GEOLOGICAL SURVEY OF CANADA
RADIOCARBON DATES XXIX

Abstract

This list presents 622 radiocarbon age determinations made by the Radiocarbon Dating Laboratory. All samples dated more than two years ago have now been reported in date lists. The total number (609) of samples from various areas are as follows: Offshore (43); Newfoundland (42); Labrador (11); Nova Scotia (39); New Brunswick (7); Champlain Sea (38); Québec (54); Ontario (23); Manitoba (3); Saskatchewan (9); Alberta (6); British Columbia (92); Yukon Territory (71); Northwest Territories, mainland (33); Northwest Territories, Arctic Archipelago (126); U.S.A. - New York (6); Washington (1); Denmark - Greenland (3). Tables 1 and 2 summarize the details of background and standard counts for the 2 L and 5 L counters during the period from December 6, 1988 to January 9, 1990.

Résumé

Ce rapport présente les résultats de 622 datations effectuées par le laboratoire de datation au radiocarbone. Tous les résultats des datations faites il y a plus de deux ans ont maintenant été présentés sous forme de listes de datations. Les échantillons datés, au nombre de 609, proviennent des régions suivantes: Régions Extracotières (43); Terre-Neuve (42); Labrador (11); Nouvelle-Ecosse (39); Nouveau-Brunswick (7); La Mer Champlain (38); Québec (54); Ontario (23), Manitoba (3); Saskatchewan (9); Alberta (6); Colombie-Britannique (92); Yukon (71); Territoires du Nord-Ouest, continent (33); Territoires du Nord-Ouest, archipel arctique (126); U.S.A. - New York (6), Washington (1); Danemark - Groenland (3). Les tableaux 1 et 2 résument les valeurs de bruit de fond et d'étalonnage des compteurs de 2 L et 5 L, de la période allant du 6 décembre 1988 au 9 janvier 1990.

INTRODUCTION[1]

This publication includes all of the samples that have been dated more than two years ago and not published in a "date list". The presentation of dates within each section or subsection of this text are ordered from east to west. All GSC dates, up to and including GSC-4400, are now accessible on a computer data base. The 'Date Locator File' provides convenient, fast access to our dates by allowing the user to interactively select indexed parameters, such as laboratory number, submitter, locality, material, age range, to retrieve samples (McNeely, 1988). Supplementary information on this data base is available from Dr. J-S. Vincent, Director, Terrain Sciences Division, Geological Survey of Canada.

Sample gas preparation and purification were carried out as described in Lowdon et al. (1977). Carbon dioxide gas proportional counting techniques have been discussed by Dyck (1967). For a review of laboratory operations the reader is referred to Lowdon (1985).

During the period from December 1988 through December 1989, both the 2 L counter (Dyck and Fyles, 1962) and the 5 L counter (Dyck et al., 1965) were operated continuously, except for the 2 L counter in December 1988. The 2 L counter was operated at 2 atmospheres (atm) throughout this period, and the 5 L counter was operated at 1 atmosphere.

On a monthly basis, the counting rates for backgrounds and standards were within statistical limits. The average background and oxalic acid standard counting rates, and the number of one-day counts used to determine the average are shown in Tables 1 and 2, respectively.

Age calculations during the report period were done on a microcomputer (VICTOR 9000). Calculations are based on a ^{14}C half-life of 5568 ± 30 years and 0.95 of the activity of the NBS oxalic acid standard. Ages are quoted in radiocarbon years before present (BP), where "present" is taken to be 1950. The error assigned to each age has been calculated using only the counting errors of sample, background, and standard, and the error in the half-life of ^{14}C (Lowdon and Blake, 1973). Nonfinite dates (i.e. greater than ages) are based on a 4 sigma criterion (99.9% probability), whereas finite dates are based on a 2 sigma criterion (95.5%

[1] The date list has been compiled by R. McNeely and S. McCuaig from descriptions of samples and interpretations of age determinations provided by the collectors and submitters.

probability) and, therefore, are unconventionally reported with an error term of ±2 sigma. In addition, all GSC dates are rounded according to the following criteria:

Age (years BP)	Significant figures
0 - 99	1
999	2
1000 - 9999	3
>10 000	3
nonfinite	2

If $^{13}C/^{12}C$ ratios ($\delta^{13}C$) were available, a "correction" for isotopic fractionation was applied to the sample age, and the $\delta^{13}C$ value reported. For terrestrial and nonmarine organic materials, and bones (both terrestrial and marine) the ages are conventionally corrected to a $\delta^{13}C$ = -25.0‰ PDB, whereas, marine shell ages are unconventionally corrected to a $\delta^{13}C$ = 0.0‰ PDB; freshwater shell ages are not corrected. All $\delta^{13}C$ determinations were made on aliquots of the sample gas used for age determinations. Since 1975 all $\delta^{13}C$ values have been determined under contract by R.J. Drimmie of the Department of Earth Sciences, University of Waterloo, Waterloo, Ontario, or by Waterloo Isotope Analysts, Inc., Kitchener, Ontario (R.J. Drimmie, Chief Analyst) using the same equipment as at the University of Waterloo. Prior to that time some $\delta^{13}C$ determinations were done by the GSC Geochronology Section (R.K. Wanless, Head) and by Teledyne Isotopes, Westwood, New Jersey.

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Appreciation is expressed to S.M. Chartrand (1969 to 1976), J.E. Tremblay (1976 to 1980), A.M. Telka (1980 to 1986), and L.M. Maillé (1986 to present), and I.M. Robertson (1964 to 1989) and J. Brennan (1989 to present) for the preparation, purification, and counting of samples in the laboratory. Supervision of laboratory operations has been as follows: W. Dyck (1960 to 1965), J.A. Lowdon (1965 to 1981), and R. McNeely (1981 to present).

Identification of materials used for dating or associated with the dated material has been carried out by the following specialists:

Algae (marine):	R.K.S. Lee, and W.H. Adey
(freshwater):	J.P. Smol
Arthropods (fossil):	J.V. Matthews, Jr.
Barnacles:	C.G. Rodrigues
Diatoms:	S. Federovich and J.P. Smol
Macrofossils (plant):	J.V. Matthews, Jr., M. Kuc, and N.F. Alley
Molluscs:	A.H. Clarke, Jr., M.F.I. Smith, the late W.H. Dall, R. Hebda, F.J.E. Wagner, C.G. Rodrigues, and J.E. Dale
Mosses:	M. Kuc, J.A. Janssens, and W.A. Weber
Pollen:	R.J. Mott, S. Federovich, N.F. Alley, and J.E. Shepperd
Vertebrates:	C.R. Harington
Wood:	R.J. Mott, L.D. Wilson (née Farley-Gill), H. Jetté, and G. Argus
Ancillary Analyses:	
Accelerator mass spectrometry (AMS) dating:	R.P. Beukens IsoTrace Laboratory, (U of T), Toronto
Amino acid ratios:	I. Moffat (N.W. Rutter), University of Alberta
X-ray diffraction: (on shell material)	A.C. Roberts and R.N. Delabio, Mineralogy Section, GSC.

The GSC clientele extend their sincere thanks to them.

M. Lanoix, R.J. Richardson, J.A. Snider, J.E. Dale, and K.E. Rolko, all former summer students or technical assistants, assisted in the processing and examination of samples prior to submission to the laboratory. Since 1986 the submitters have been responsible for the (physical) preparation of their sample materials, with supervision from laboratory personnel, prior to their submission to the laboratory.

W. Spirito, L. Brouillette, J. Cousineau, and J. Wilhem assisted in the development of the 'Date Locator File'. D. Atkinson assisted in the preparation of this report.

Table 1. Monthly average count rate for backgrounds and the number of individual counts (N) made during the period December 1988 through December 1989.

Month	2L Counter (2 atm) cpm*	(N)	5L Counter (1 or 4 atm) cpm*	(N)
December 1988			2.221 ± 0.031	(3)
January 1989	1.103 ± 0.016	(5)	2.166 ± 0.034	(5)
February	1.109 ± 0.018	(4)	2.135 ± 0.026	(4)
March	1.114 ± 0.019	(4)	2.152 ± 0.026	(4)
April	1.092 ± 0.018	(4)	2.157 ± 0.026	(4)
May	1.072 ± 0.016	(5)	2.153 ± 0.022	(5)
June	1.064 ± 0.019	(4)	2.172 ± 0.022	(5)
July	1.090 ± 0.023	(3)	2.127 ± 0.043	(3)
August	1.077 ± 0.015	(6)	2.186 ± 0.024	(5)
September	1.067 ± 0.019	(4)	2.109 ± 0.032	(3)
October	1.070 ± 0.019	(4)	2.151 ± 0.026	(4)
November	1.094 ± 0.019	(4)	2.174 ± 0.027	(4)
December	1.073 ± 0.016	(5)	2.189 ± 0.023	(5)

* cpm = counts per minutes
** No = 95% of the net activity of the NBS Oxalic Acid Standard

Table 2. Monthly average net count rate for oxalic acid standards (No**) and the number of individual counts (N) made during the period December 1988 through December 1989.

Month	2L Counter (2 atm) cpm*	(N)	5L Counter (1 of 4 atm) cpm*	(N)
December 1988			28.121 ± 0.123	(3)
January 1989	18.125 ± 0.099	(2)	28.137 ± 0.173	(1)
February	18.080 ± 0.095	(3)	28.327 ± 0.120	(3)
March	17.921 ± 0.095	(2)	28.221 ± 0.122	(3)
April	18.072 ± 0.097	(2)	28.419 ± 0.123	(2)
May	18.025 ± 0.147	(2)	28.455 ± 0.126	(2)
June	17.975 ± 0.097	(3)	28.325 ± 0.122	(2)
July	17.970 ± 0.101	(2)	28.373 ± 0.167	(2)
August	17.836 ± 0.153	(3)	28.589 ± 0.128	(3)
September	17.658 ± 0.099	(2)	28.604 ± 0.129	(2)
October	17.936 ± 0.117	(3)	28.579 ± 0.127	(3)
November	17.841 ± 0.101	(2)	28.144 ± 0.179	(1)
December	18.101 ± 0.100	(3)	28.283 ± 0.127	(3)

* cpm = counts per minute
** No = 95% of the net activity of the NBS Oxalic Acid Standard

EASTERN CANADA

Offshore

A suite of marine sediments were collected by piston and vibrocorers from:

1) the basinal areas of the eastern Gulf of Maine,
2) Emerald Basin on the central Scotian Shelf, and
3) Placentia Bay on the central Grand Banks of Newfoundland, southwest of the Avalon Peninsula, Newfoundland.

Gulf of Maine Series

Five marine sediment cores were collected off the coast of Nova Scotia, in Georges Basin, Sewell Ridge, and Crowell Basin by L.H. King in June 1976. Sixteen samples were submitted for dating by L.H. King.

Georges Basin

The marine sediment core, 76-016-CO No. 3, was collected 150 km southwest of Yarmouth, north of Georges Basin (42°40.60′N, 67°6.00′W), in a water depth of 268 m.

GSC-2697. Georges Basin (I) 15 300 ± 390
$\delta^{13}C$= -18.9‰

The organic mud sample from a core depth of 170-195 cm (323 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 4.04.

The uncorrected age is 15 200 ± 390.

GSC-2711. Georges Basin (II) >19 000
$\delta^{13}C$= -22.3‰

The organic mud sample from a core depth of 550-575 cm (402 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 9.90.

GSC-2735. Georges Basin (III) 21 600 ± 690
$\delta^{13}C$= -21.6‰

The organic mud sample from a core depth of 733-783 cm (885 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count 2 L counter with a mixing ratio of 3.63.

The uncorrected age is 21 500 ± 690.

GSC-2683. GeorgesBasin (IV) 19 900 ± 1200
$\delta^{13}C$= -23.3‰

The organic mud sample from a core depth of 783-808 cm (320 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 8.94.

The uncorrected age is 19 800 ± 1200.

The marine sediment core, 76-016-CO No. 4, was collected 150 km southwest of Yarmouth, north of Georges Basin (42°41.90′N, 67°6.20′W), in a water depth of 241 m.

GSC-2939. Georges Basin (V) 19 000 ± 530
$\delta^{13}C$= -23.1‰

The organic mud sample from a core depth of 40-80 cm (560 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count 2 L counter with a mixing ratio of 2.68.

The uncorrected age is 18 900 ± 530.

GSC-2755. Georges Basin (VI) 18 000 ± 990
$\delta^{13}C$= -20.2‰

The organic mud sample from a core depth of 275-300 cm (480 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count 2 L counter with a mixing ratio of 9.03.

The uncorrected age is 18 000 ± 990.

Sewell Ridge

The marine sediment core, 76-016-CO No. 5, was collected 140 km southwest of Yarmouth, on Sewell Ridge (42°48.20′N, 67°5.80′W), in a water depth of 237 m.

GSC-2967. Sewell Ridge (I) 22 600 ± 1080
$\delta^{13}C$= -23.7‰

The organic mud sample from a core depth of 130-165 cm (570 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 3.64.

The uncorrected age is 22 600 ± 1080.

GSC-2770. Sewell Ridge (II) >18 000
$\delta^{13}C$= -25.1‰

The organic mud sample from a core depth of 207-232 cm (259 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 7.98.

GSC-2962. Sewell Ridge (III) 24 800 ± 1130
$\delta^{13}C$= -24.5‰

The organic mud sample from a core depth of 430-475 cm (639 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 2.91.

The uncorrected age is 24 800 ± 1130.

GSC-2789. Sewell Ridge (IV) >18 000
$\delta^{13}C$= -20.1‰

The organic mud sample from a core depth of 519-544 cm (332 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 8.49.

GSC-2715. Sewell Ridge (V) 26 600 ± 1600
$\delta^{13}C$= -18.1‰

The organic mud sample from a core depth of 735-760 cm (447 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 4.84.

The uncorrected age is 26 500 ± 1600.

Crowell Basin

The marine sediment core, 76-016-CO No. 6, was collected 120 km southwest of Yarmouth, in northern Crowell Basin (43°0.10′N, 67°4.10′W), in a water depth of 195 m.

GSC-2810. Crowell Basin (I) 17 600 ± 620
$\delta^{13}C$= -20.8‰

The organic mud sample from a core depth of 125-150 cm (776 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 5.35.

The uncorrected age is 17 500 ± 620.

GSC-2801. Crowell Basin (II) 17 400 ± 670
$\delta^{13}C$= -19.8‰

The organic mud sample from a core depth of 415-440 cm (717 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 5.17.

The uncorrected age is 17 300 ± 670.

The marine sediment core, 76-016-CO No. 2, was collected 110 km southwest of Yarmouth, in Crowell Basin (43°3.25′N, 67°3.90′W), in a water depth of 197.5 m.

GSC-2947. Crowell Basin (III) 6060 ± 170
$\delta^{13}C$= -23.1‰

The organic mud sample from a core depth of 25-55 cm (641 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.64.

The uncorrected age is 6060 ± 170.

GSC-2944. Crowell Basin (IV) 11 100 ± 150
$\delta^{13}C$= -23.1‰

The organic mud sample from a core depth of 130-160 cm (537 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 1.53.

The uncorrected age is 11 100 ± 150.

GSC-2709. Crowell Basin (V) 17 000 ± 900
$\delta^{13}C$= -20.3‰

The organic mud sample from a core depth of 224-249 cm (4.04 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count 2 L counter with a mixing ratio of 8.77.

The uncorrected age is 16 900 ± 900.

Emerald Basin Series

Eleven marine sediment cores were collected in the eastern and northeastern region of Emerald Basin, on the central area of the Scotian Shelf, by L.H. King in June 1979. Twenty-one samples were submitted for dating by L.H. King.

The marine sediment core, 79-011-CO No. 1p, was collected in northeastern Emerald Basin (44°33.0′N, 61°25.2′W), in a water depth of 142 m.

GSC-3255. Emerald Basin (I) 6480 ± 70
$\delta^{13}C$= -23.3‰

The organic mud sample from a core depth of 15-55 cm (413.2 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.29.

The uncorrected age is 6450 ± 70.

GSC-3258. Emerald Basin (II) 11 600 ± 120
$\delta^{13}C$= -23.0‰

The organic mud sample from a core depth of 324-359 cm (410.7 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 600 ± 120.

GSC-3260. Emerald Basin (III) 15 100 ± 230
$\delta^{13}C$= -23.5‰

The organic mud sample from a core depth of 650-680 cm (400.3 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.60.

The uncorrected age is 15 100 ± 230.

GSC-3272. Emerald Basin (IV) 16 400 ± 180
$\delta^{13}C$= -23.0‰

The organic mud sample from a core depth of 807-837 cm (412.5 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 2 L counter with a mixing ratio of 1.47.

The uncorrected age is 16 400 ± 180.

The marine sediment core, 79-011-CO No. 11p, was collected in northeastern Emerald Basin (44°39.28′N, 61°46.86′W), in a water depth of 150 m.

GSC-3164. Emerald Basin (V) 26 900 ± 650
$\delta^{13}C$= -24.8‰

The organic mud sample from a core depth of 80-120 cm (669.0 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.69.

The uncorrected age is 26 900 ± 650.

GSC-3231. Emerald Basin (VI) 30 900 ± 540
$\delta^{13}C$= -26.1‰

The organic mud sample from a core depth of 560-590 cm (553.0 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 30 900 ± 540.

The marine sediment core, 79-011-CO No. 2p, was collected in northeastern Emerald Basin (44°41.9′N, 61°25.0′W), in a water depth of 135 m.

GSC-3263. Emerald Basin (VII) >34 000
$\delta^{13}C$= -25.5‰

The organic mud sample from a core depth of 10-40 cm (447.8 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.00.

GSC-3264. Emerald Basin (VIII) 34 300 ± 960
$\delta^{13}C$= -25.6‰

The organic mud sample from a core depth of 155-190 cm (462.1 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.31.

The uncorrected age is 34 300 ± 960.

GSC-3265. Emerald Basin (IX) >38 000
$\delta^{13}C$= -25.5‰

The organic mud sample from a core depth of 262-295 cm (411.8 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.00.

The marine sediment core, 79-011-CO No. 8p, was collected in northeastern Emerald Basin (44°43.4'N, 61°18.0'W), in a water depth of 111 m.

GSC-3271. Emerald Basin (X) 37 800 ± 1900
$\delta^{13}C$= -25.0‰

The organic mud sample from a core depth of 21-61 cm (649.3 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.35.

The uncorrected age is 37 800 ± 1900.

The marine sediment core, 76-011 No. 7p, was collected in northeastern Emerald Basin (44°43.5'N, 61°12.6'W), in a water depth of 91 m.

GSC-2979. Emerald Basin (XI) 41 800 ± 1790
$\delta^{13}C$= -15.3‰

The organic mud sample from a core depth of 15-55 cm (1380 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 41 600 ± 1790.

The marine sediment core, 79-011-CO No. 9p, was collected in northeastern Emerald Basin (44°43.9'N, 61°17.75'W), in a water depth of 111 m.

GSC-3138. Emerald Basin (XII) >33 000
$\delta^{13}C$= -23.5‰

The organic mud sample from a core depth of 25-65 cm (664.0 g dry weight) was calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.00.

GSC-3068. Emerald Basin (XIII) >33 000
$\delta^{13}C$= -24.4‰

The organic mud sample from a core depth of 135-175 cm (770.0 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 5 L counter with a mixing ratio of 1.36.

The marine sediment core, 79-011 No. 2v, was collected in northeastern Emerald Basin (44°44.1'N, 61°24.5'W), in a water depth of 124.4 m.

GSC-2995. Emerald Basin (XIV)
uncorrected 36 500 ± 1370

The organic mud sample from a core depth of 233-280 cm (1420 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 36 500 ± 1370.

The marine sediment core, 79-011 No. 6p, was collected in northeastern Emerald Basin (44°44.4'N, 61°13.9'W), in a water depth of 97 m.

GSC-3115. Emerald Basin (XV) 33 600 ± 930
$\delta^{13}C$= -18.1‰

The organic mud sample from a core depth of 15-55 cm (1321 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 33 500 ± 930.

GSC-3095. Emerald Basin (XVI) 32 200 ± 1030
$\delta^{13}C$= -24.3‰

The organic mud sample from a core depth of 115-155 cm (2383 g wet weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.71.

The uncorrected age is 32 200 ± 1030.

The marine sediment core, 76-011 No. 3v, was collected in northeastern Emerald Basin (44°45.0'N, 61°24.2'W), in a water depth of about 120 m.

GSC-2987. Emerald Basin (XVII) 35 400 ± 810
$\delta^{13}C$= -18.0‰

The organic mud sample from a core depth of 232-285 cm (1420 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 35 300 ± 810.

The marine sediment core, 76-011 No. 4p, was collected in northeastern Emerald Basin (44°46.1'N, 61°25.3'W), in a water depth of 117 m.

GSC-2983. Emerald Basin (XVIII) uncorrected — 39 500 ± 1390

The organic mud sample from a core depth of 38-78 cm (1350 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 39 500 ± 1390.

The marine sediment core, 79-011-CO No. 12p, was collected in eastern Emerald Basin (43°47.8'N, 62°36.3'W), in a water depth of 165 m.

GSC-3251. Emerald Basin (XIX) — 35 000 ± 1600
$\delta^{13}C$= -25.1‰

The organic mud sample from a core depth of 425-455 cm (510.2 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.62.

The uncorrected age is 35 000 ± 1600.

GSC-3244. Emerald Basin (XX) — 27 300 ± 600
$\delta^{13}C$= -25.3‰

The organic mud sample from a core depth of 570-600 cm (659.3 g dry weight) was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.69.

The uncorrected age is 27 300 ± 600.

The marine sediment core, 79-011-CO No. 10p, was collected in northeastern Emerald Basin (44°42.0'N, 61°46.5'W), in a water depth of 133 m.

GSC-3152. Emerald Basin (XXI) — 36 300 ± 980
$\delta^{13}C$= -21.5‰

The organic mud sample from a core depth of 550-580 cm (608.0 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 36 200 ± 980.

Placentia Bay Series

Three marine sediment cores were collected off the coast of Newfoundland, in Placentia Bay by G.B.J. Fader in June 1978. Six samples were submitted for dating by L.H. King.

The marine sediment core, HN 78-012-CO No. 132A, was collected in Placentia Bay (46°30.5'N, 54°43.7'W), in a water depth of 263 m.

GSC-2933. Placentia Bay (I) — 7490 ± 80
$\delta^{13}C$= -23.3‰

The organic mud sample from a core depth of 30-85 cm (645 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7460 ± 80.

GSC-2926. Placentia Bay (II) — 14 100 ± 200
$\delta^{13}C$= -23.3‰

The organic mud sample from a core depth of 810-850 cm (510 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.68.

The uncorrected age is 14 100 ± 200.

The marine sediment core, HN 78-012-CO No. 321, was collected in Placentia Bay (46°45.60'N, 54°36.20'W), at a depth of 181 m.

GSC-2999. Placentia Bay (III) — 22 700 ± 730
$\delta^{13}C$= -22.7‰

The organic mud sample from a core depth of 56-95 cm (883 g wet weight) was treated with hot acid and distilled water rinses; base was treatment omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 2.23.

The uncorrected age is 22 700 ± 730.

GSC-2890. Placentia Bay (IV) — 21 800 ± 760
$\delta^{13}C$= -25.8‰

The organic mud sample from a core depth of 170-210 cm (735 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 2 L counter with a mixing ratio of 3.12.

The uncorrected age is 21 800 ± 760.

The marine sediment core, HN-78-012-CO No. 223, was collected in Placentia Bay (46°52.80'N, 54°51.80'W), in a water depth of 227 m.

GSC-2874. Placentia Bay (V) — 14 800 ± 330
$\delta^{13}C$= -26.7‰

The organic mud sample from a core depth of 15-50 cm (616 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 4 day count in the 2 L counter with a mixing ratio of 3.86.

The uncorrected age is 14 800 ± 330.

GSC-2866. Placentia Bay (VI) 22 200 ± 1450
$\delta^{13}C$= -24.7‰

The organic mud sample from a core depth of 160-195 cm (632 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 3.96.

The uncorrected age is 22 200 ± 1450.

Comment (G.B.J. Fader): These cores were part of a program to map the surficial sediments in the southeastern Canadian offshore and to determine the timing and history of glacial advances and retreats across the continental shelf. Most of the materials collected were from type sections interpreted on the basis of high-resolution seismic reflection data from the basinal areas of the shelf, which preserve glaciomarine sediments and interbeds of till called "till tongues" (King and Fader, 1986). These sediments are thought to have been deposited during retreat of the Wisconsinan glaciers. All the samples had very low organic contents. The total organic carbon content in the bulk samples was dated. On the basis of these dates, King and Fader, (1986) proposed a chronology for the offshore that suggested a long period of Middle Wisconsinan recession and deglaciation. The recent advent of the AMS ^{14}C dating technique (not available to King and Fader at the time of the original study) is helping to provide a more accurate chronology for these sediments. Ten AMS dates from the northeastern area of Emerald Basin have been recently obtained. They were chosen at horizons at or close to previously dated total organic carbon samples.

Core Number	Depth (cm)	Enclosing Material	Radiocarbon Age (BP): Shell AMS Date	Total Organic Carbon Conventional Date	
79-011-9P	87	LaHave Clay	6120 ± 150	6480 ± 70	GSC 3056
79-011-9P	559	LaHave Clay	7740 ± 170	11 600 ± 120	GSC 3058
79-011-9P	597	LaHave Clay	8450 ± 100		
79-011-9P	701	Emerald Silt, facies B (upper)	10 960 ± 140	10 100 ± 230	GSC 3060
79-011-9P	819	Emerald Silt, facies B	10 240 ± 350	10 400 ± 180	GSC 3072
82-003-4a	210	Emerald Silt, facies E	13 550 ± 150		
82-003-6a	280	Emerald Silt, facies B	14 250 ± 130		
79-011-10	398	Emerald Silt, facies A (upper)	14 660 ± 120		
79-011-10	552	Emerald Silt, facies A (upper)	14 630 ± 150	30 300 ± 480	GSC 3152
79-011-11	495	Emerald Silt, facies A (upper)	14 650 ± 170	30 600 ± 540	GSC 3231

These new dates from this area suggest that the total organic carbon dates are in error probably as a result of reworked organic detritus being incorporated in the sediments. The glacial section of Emerald Basin now appears to be largely Late Wisconsinan in age (King and Fader, 1988, 1989). Based on these new findings we must temper the interpretation of the glacial chronology of the Gulf of Maine and Placentia Bay based on the total organic carbon dates and realize that those dates also are probably too old.

Laboratory Comment: Sediment samples containing little organic carbon are very prone to giving anomalously old ages because the proportion of reworked 'old' organic material (including coal, etc.) can be large. As of 1986, the Radiocarbon Dating Laboratory has, with the concurrence of the Geochronology Committee, implemented a requirement for a minimum organic content of 2% organic carbon (or 5% organic matter) in all samples dated at GSC. The organic carbon content of these samples varied from 0.12 to 1.5%, thus none would be considered for dating today. Although some of the dates presented in this study may be valid, most should be used with caution or preferably not used at all in any synthesis of the glacial and deglacial history of eastern Canada.

Newfoundland

A number of the age determinations pertaining to western and southern Newfoundland were made in support of a systematic Quaternary geological mapping project of Newfoundland. Most are shown on published maps (Grant, 1986a, 1989a, 1990) and have been discussed in various reports on the area (Grant, in press). They serve to quantify the rate of Late Wisconsinan deglaciation and relative sea level change. In sum, they show that the last major advance from local highland ice caps reached the present coast after 25 ka, retreated inland 14-12 ka, and readvanced locally about 11 ka. From its deglacial maximum against the ice front, sea level fell rapidly because of isostatic crustal rebound, crossing its present level at various times between 10 ka and 2 ka depending on latitude, before rising again to its present position because of crustal subsidence.

GSC-4670. Lawn 970 ± 80
$\delta^{13}C$= -26.1‰

The wood (*Abies balsamea*; identified by H. Jetté (unpublished GSC Wood Report No. 88-26)) was overlain by salt marsh peat. Sample 85.GS.21 was collected by D.R. Grant on August 14, 1985 from the southern part of the village of Lawn, Burin Peninsula, south coast of Newfoundland (46°56.58'N,55°32.65'W), at a depth of 1.22 m; submitted by D.R. Grant.

The sample (11 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 990 ± 80.

Comment (D.R. Grant): The wood was the outer 1 cm of a small 10 cm diameter tree stump (at the junction of root and trunk), which was rooted in till and overlain by salt-marsh peat in the intertidal zone. It was situated 1.22 m below present highest tide level — the present lower limit of living trees and other freshwater vegetation. Since no freshwater peat intervenes between the tree stump and the marine sediment, the death of the submerged tree dates the arrival of saltwater conditions at this level. The date thus yields an average rate for relative sealevel rise of 12 cm/100 a. This

compares with, but is considered more reliable than, the 15 cm/100 a rate derived by Tucker et al. (1982) from a submerged tree that was overlain by freshwater peat (GSC-2617, 1080 ± 50 BP, Lowdon and Blake, 1981).

GSC-4785. Grand Beach Point 3280 ± 60
$\delta^{13}C$= -25.5‰

The wood (*Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 88-34)) was enclosed in peat. Sample 85-GS-51 was collected by D.R. Grant on August 8, 1985 near the village of Grand Beach, 1 km southeast of Grand Beach Point, on shore of Fortune Bay, north coast of Burin Peninsula, southern Newfoundland (55°30.62'N, 47°8.35'W), at a depth 1.0 m; submitted by D.R. Grant.

The sample (11.3 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3280 ± 60.

Comment (D.R. Grant): The wood sample was the outer 5 cm (50 annual rings) of the root of a 20 cm diameter tree stump that was rooted in the gravel of a raised marine terrace that was overlain by 1-1.5 m of shrubby *Sphagnum* peat. The deposit was being wave eroded and the forest layer was 1 m below highest tide level. The dating was intended both to be a minimum measure of the present rate of Late Holocene sea level rise and to demonstrate the indirect effect of submergence whereby a rising sea elevates groundwater level, which in turn initiates bogs and marshes that kill low lying coastal forests by paludification. The submerged forest at this site is at the same subtidal level but died 2 ka earlier than the one nearby at Lawn (GSC-4670), which indicates that high tide level reached the -1 m elevation about 1 ka. The date thus shows that the hydrologic effect of rising sea level reaches far inland and precedes the actual arrival of the shoreline by transgression. This relationship is not widely appreciated, yet is important in understanding the current impact of rising sea level on inland sites, particularly in low gradient areas where groundwater is most sensitive to sea level movement.

GSC-4685. Kents Pond 7350 ± 130
$\delta^{13}C$= -21.4‰

The basal lake sediment (sample Kent 500-505; clay-gyttja with a shrub-tundra assemblage containing abundant *Pediastrum* identified by S. Vardy) was collected by J.B. Macpherson on October 5, 1987 from Kents Pond, 3 km northwest of St. John's Harbour, St. John's, Newfoundland (47°35'16"N, 52°43'6"W), at an elevation of 71 m; submitted by J.B. Macpherson.

The sample (68.9 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4210 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.91.

The uncorrected age is 7290 ± 130.

Comment (J.B. Macpherson): The dated sample is the lowest datable sediment (5.00-5.05 m below the sediment/water interface) from a core 5.41 m in length taken with a modified Livingstone corer in a water depth of 1.64 m from Kents Pond, St. John's, Newfoundland. The top 4.69 m of the core consists of gyttja, underlain by clay-gyttja (4.69-5.05 m), the lowest segment of which was dated, resting upon clay (5.05-5.41 m). The base was impenetrable. The date may be too young. It is 1000 years younger than the previously reported youngest basal date from the northeast Avalon Peninsula (Northeast Pond, Pouch Cove, 22 km north, 8370 ± 110 BP, GSC-2961; Lowdon and Blake, 1981). Kents Pond is adjacent to Kenny's Pond, where the basal date is itself young, but not inconsistent with other evidence (8570 ± 90 BP, GSC-3618; Blake, 1983). The basal pollen sequence from Kenny's Pond shows a rapid plant colonization after late deglaciation of a site in an already vegetated landscape. If a residual ice mass had occupied the Kents Pond basin for as long as the date suggests, there should have been an (equally) rapid change in the pollen spectra. However, the pollen sequence above the dated sample indicates a gradual transition from shrub-tundra to forest at 4.6 m where *Picea* increases. The *Picea* increase is dated about 8.5 ka on the northeastern Avalon Peninsula (e.g., Golden Eye Pond, 35 km southwest, 8370 ± 130 BP, GSC-4015; Blake, 1987; other sites by interpolation); GSC-4605 suggests an anomalous date of 6.7 ka for the *Picea* rise at Kents Pond.

GSC-4182. Parsons Point 12 000 ± 240
$\delta^{13}C$= +0.6‰

The marine shells (barnacles) were enclosed in silty clay. Sample 2F/4-53 (1975) was collected by D.G. Vanderveer on July 9, 1975 from a ditch at Parsons Point, Bonavista Bay, Newfoundland (49°2'N, 54°52'W), at an elevation of about 2 m; submitted by D.G. Vanderveer.

The sample (12.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 1050 minutes (one 1 day) in the 2 L counter with a mixing ratio of 1.82.

The uncorrected age is 12 000 ± 240.

Comment (D.G. Vanderveer): There have been few postglacial fossils located in eastern Newfoundland and this locality is the farthest east and the oldest identified to present. The date represents a minimum age for the deglaciation of coastal areas of eastern Newfoundland and indicates that Bonavista Bay was ice free prior to 12.0 ka. The date helps constrain the inferred 12-13 ka age for a major ice marginal stand marked by end moraines and ice contact deltas encircling Newfoundland (Grant, 1989b, p. 414).

GSC-4327. "East Twin Pond" 11 700 ± 160
$\delta^{13}C$= -23.6‰

The lake sediment (clay-gyttja) was underlain by clay. Sample ETG 640-645 was collected by J.B. Macpherson on June 26, 1984 from "East Twin Pond" (informal local name), south of, and adjacent to, Highway 1, 6 km west of west end

of the town of Gander, Newfoundland (48°57.5′N, 54°43.0′W), at an elevation of about 80 m; submitted by J.B. Macpherson.

The sample (21.6 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2410 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.69.

The uncorrected age is 11 700 ± 160.

Comments (J.B. Macpherson): A 669 cm core was obtained in a water depth of 476 cm from a circular basin at the south end of the lake, using a modified Livingstone sampler 5 cm in diameter. The dated sample, from 640-645 cm below the sediment/water interface, was the basal organic sediment, containing a sedge tundra pollen assemblage, which overlies 24 cm of silty clay. The date is minimal for deglaciation. The mean rate of sediment accumulation for the organic segment of the core, 0.055 cm/a, is higher than normal for the region and is probably related to sediment focusing.

The date adds to evidence of general deglaciation of northern and east-central Newfoundland between 12.0 and 11.4 ka. Three other minimal deglacial dates from lake sites fall within this period (GSC-3647, 11 800 ± 200 BP; Blake, 1983; GSC-3891, 11 700 ± 180 BP; Blake, 1986; GSC-3957, 11 800 ± 200 BP; Blake, 1987) as do eight reported dates from marine shells (cf. Dyck and Fyles, 1963; Blake, 1983). A further minimal deglacial date from the height of land 120 km south-southwest of the present site, previously reported (GSC-3634, 11 300 ± 100 BP; Blake, 1983), suggests that much of east-central Newfoundland was ice-free before 11.0 ka. While minimal dates from the western interior are less conclusive (GSC-4186, 9300 ± 170 BP; GSC-4231, 9340 ± 140 BP), they suggest later deglaciation of that area. This evidence suggests that any recessional stand of the margin of the island icecap along a moraine bounding the "inner drift zone" of Jenness (1960) was of short duration.

Bishop's Falls Series

Two lake sediment (gyttja) samples were collected from a small lake (kettle?) on the west side of Route 360, 9.5 km south-southwest of Bishop's Falls, Newfoundland (48°56.17′N, 55°30.33′W), at an elevation of about 75 m, by J.B. Macpherson on July 16, 1982; submitted by J.B. Macpherson.

GSC-4148. Bishop's Falls (I) 6340 ± 70
$\delta^{13}C$= -30.0‰

The sample, BF 225-230 (35.6 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 6840 minutes (one 5 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6420 ± 70.

GSC-4131. Bishop's Falls (II) 10 800 ± 140
$\delta^{13}C$= -30.7‰

The sample, BF 290-295 (34.3 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.41.

The uncorrected age is 10 900 ± 140.

Comments (J.B. Macpherson): A 371 cm core was obtained using a modified Livingstone corer from a water depth of 3.2 m. GSC-4131 was obtained at 290-295 cm below the sediment/water interface and dates the initial rise of *Picea* pollen at the site, the earliest date for this event so far obtained from Newfoundland. GSC-4148 was obtained at 225-230 cm below the sediment/water interface and dates an increase in *Pinus* pollen. Mean rates of sedimentation varied from 0.024 cm/a between 11.8 and 10.8 ka, to 0.015 cm/a between 10.8 and 6.3 ka and 0.036 cm/a from 6.3 ka to the present.

GSC-4122. Bay d'Espoir Highway 8530 ± 120
$\delta^{13}C$= -25.7‰

The lake sediment (gyttja) (sample BDH 341-346; 36.1 g wet weight) was collected from 85.5 km south of Bishop's Falls, on west side of Route 360 (Bay d'Espoir Highway), Newfoundland (48°14.83′N,55°29.58′W), at an elevation of 200 m, by J.B. Macpherson on July 15, 1982; submitted by J.B. Macpherson.

The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.99.

The uncorrected age is 8540 ± 120.

Comments (J.B. Macpherson): GSC-4122 was obtained from the same site as GSC-3634 (11 300 ± 100 BP; Blake, 1983), at 341-346 cm below the sediment/water interface, and dates the main rise of *Picea* pollen. The mean sedimentation rate was 0.024 cm/a between 11.3 and 8.5 ka, and 0.040 cm/a from 8.5 ka to the present.

GSC-4186. Meelpaeg Lake 9300 ± 170
$\delta^{13}C$= -20.2‰

The lake sediment (gyttja) (sample HP 253-258; 6.7 g dry weight) was collected from 42 km south of Millertown, 9.2 km south of the ford across Noel Paul's Brook on the road to Meelpaeg Lake (reservoir), Newfoundland (48°26.5′N, 56°35.0′W), at an elevation of about 345 m, by J.B. Macpherson on September 13, 1984; submitted by J.B. Macpherson.

The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.23.

The uncorrected age is 9220 ± 170.

Comments (J.B. Macpherson): A 258 cm core was obtained with a modified Livingstone sampler 5 cm in diameter in a water depth of 54 cm from the only accessible small lake on this section of the central Newfoundland plateau. The dated sediment, from 253-258 cm below the sediment/water interface, rested on bedrock or a boulder and contained a pollen assemblage indicative of a shrub-tundra vegetation. This, together with the absence of basal inorganic sediment, indicates that the date is only minimal for deglaciation. The mean rate of sedimentation in the core is 0.027 cm/a.

GSC-4231. "West Twin Pond" 9340 ± 140
$\delta^{13}C$= -25.9‰

The basal lake sediment (gyttja) (sample WTM 167-172; 23.7 g wet weight) was collected from "West Twin Pond" (informal local name), 3.5 km south of Millertown dam (outlet of Exploits River from Red Indian Lake), Millertown, Newfoundland (48°44'N, 56°36'W), at an elevation of about 250 m, by J.B. Macpherson on September 12, 1984; submitted by J.B. Macpherson.

The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2340 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.50.

The uncorrected age is 9360 ± 140.

Comment (J.B. Macpherson): A 172 cm core was obtained with a modified Livingstone sampler of diameter 5 cm in a water depth of 75 cm from the western of a pair of small connecting lakes (kettles?) known locally as the Twin Ponds. The dated sediment, from 167-172 cm below the sediment/water interface, rested on bedrock or a boulder; the date marks the initial *Picea* rise and is thus minimal for deglaciation. This can be confirmed by a core taken from "East Twin Pond", (informal local name) which extended lower in the stratigraphic and pollen sequence, bottoming in laminated, partly thixotropic silty clay. The mean rate of sedimentation in the West Pond core was 0.018 cm/a.

Leading Tickles South Series

A series of lake sediment (gyttja) samples were collected from the east side of Highway 350, 3.2 km south of Leading Tickles South, 15.4 km north-northwest of Point Leamington, Notre Dame Bay, Newfoundland (49°28.28'N, 55°28.38'W), at an elevation of about 105 m, by J.B. Macpherson on July 14, 1982; submitted by J.B. Macpherson. The series of samples were submitted from cores of sediment to provide minimal dates for deglaciation, to date specific palynostratigraphic horizons and to provide information on sedimentation rates.

GSC-4107. Leading Tickles South (I) 4200 ± 110
$\delta^{13}C$= -28.9‰

The sample, LT II 210-215 (55.6 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2060 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.20.

The uncorrected age is 4260 ± 110.

GSC-4086. Leading Tickles South (II) 5960 ± 120
$\delta^{13}C$= -27.7‰

The sample, LT II 265-270 (59.9 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2290 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.47.

The uncorrected age is 6010 ± 120.

GSC-4183. Leading Tickles South (III) 9600 ± 230
$\delta^{13}C$= -24.4‰

The sample, LT 380-385 (13.4 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5760 minutes (one 4 day) in the 2 L counter with a mixing ratio of 3.30.

The uncorrected age is 9590 ± 230.

Comment (J.B. Macpherson): These samples were obtained from another core at the same location as GSC-3608 (13 200 ± 300 BP) and GSC-3610 (10 500 ± 140 BP) (Blake, 1983; Macpherson and Anderson, 1985), a small lake on the east of Route 350 (Note: it was stated as being located on the west side in Blake, 1983).

A 460 cm core was obtained using a modified Livingstone corer from a water depth of 3.3 m, in a pond. Within the basal clay-gyttja there was a layer of silty clay. The clay-gyttja from immediately above the silty clay layer was dated at 10 500 ± 140 BP (GSC-3610), while that from the base of the core was dated at 13 200 ± 300 BP (GSC-3608); a minimum for deglaciation, and the earliest terrestrial date from this section of the island (Macpherson and Anderson, 1985).

GSC-4107 was taken from 210-215 cm below the sediment/water interface, while GSC-4086 was taken from 265-270 cm below it. The cores were adjacent to that from which the basal dates were obtained and were correlated by pollen stratigraphy. GSC-4183 was taken from 380-385 cm below the sediment/water interface in the core from which the basal dates were obtained.

GSC-4086 and -4107 date the beginning and end, respectively, of a period of increased *Pinus* (mainly *Pinus glauca*) values that may correspond with the Hypsithermal at this site. GSC-4183 dates the initial rise in *Picea* values and the probable arrival of spruce trees. The increases in both *Picea* and *Pinus* occurred later at this coastal site than at the Bishop's Falls site, 65 km to the south, suggesting migration

of trees from the south and possible delayed response to climatic change in proximity to the ocean. Mean sedimentation rates increased from 0.010 cm/a between 13.2 and 10.5 ka, to about 0.030 cm/a between 10.5 and 4.2 ka (0.031 cm/a between 10.5 and 9.6 ka; 0.033 cm/a between 9.6 and 5.96 ka; 0.028 cm/a between 5.96 and 4.2 ka) and 0.051 cm/a from 4.2 ka to the present.

GSC-4657. Leading Tickles South 11 100 ± 210
$\delta^{13}C = -16.1‰$

The lake sediment (basal gyttja) was overlain by gyttja and underlain by silty clay. Sample LTN 485-490 was collected by J.B. Macpherson on September 10, 1987 from 2 km south of village of Leading Tickles South, Notre Dame Bay, Newfoundland (49° 28.8'N, 55° 26.7'W), at an elevation of about 87 m; submitted by J.B. Macpherson.

The sample (93.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2320 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.98.

The uncorrected age is 11 000 ± 210.

Comment (J.B. Macpherson): The site (designated Leading Tickles site II) was sampled in a search for further evidence of the "Younger Dryas" sequence apparent from the Leading Tickles site, 1.5 km to the southwest (Macpherson and Anderson, 1985). No such evidence was found, but the basal date agrees with the date of recovery from the cold oscillation obtained from the Leading Tickles site (10 500 ± 140 BP, GSC-3610, Blake, 1983). The sampling site was at the broader northern end of a small headwater lake draining north to Leading Tickles, east of and adjacent to Highway 35, 2 km south of the settlement of Leading Tickles South. The dated sample is from the lowest datable sediment (4.85-4.90 m below the sediment/water interface) in a core 5.15 m in length taken with a modified Livingstone corer in a water depth of 2.90 m. The core consisted of gyttja (0-4.60 m) grading to clay-gyttja (4.60-4.91 m), overlying silty clay with grit and stones at the base, upon rock. The date is minimal for deglaciation of this site. The pollen assemblage of the dated sediment is indicative of sparse herb tundra and correlates with a level below the sample dated 10.5 ka from the original Leading Tickles site. The latter contains a pollen assemblage indicative of a herb-shrub tundra; *Pediastrum* concentrations are high in both samples.

GSC-4636. "Hynes Cove Pond" 10 900 ± 160
$\delta^{13}C = -18.7‰$

The basal lake sediment (clay-gyttja) with a sedge-tundra pollen assemblage containing abundant *Pediastrum* was overlain by gyttja and underlain by clay. Sample TRIT 543.5-550 was collected by J.B. Macpherson on June 25, 1986 from "Hynes Cove Pond" (informal local name), 1 km southwest of Brighton Tickle causeway, on south side of road, Triton Island, Notre Dame Bay, Newfoundland (49°31.95'N, 55°39.18'W), at an elevation of 23.15 m; submitted by J.B. Macpherson.

The sample (55.4 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on three counts for 4400 minutes (three 1 day) in the 2 L counter with a mixing ratio of 1.83.

The uncorrected age is 10 800 ± 160.

Comment (J.B. Macpherson): The dated sample (5.435-5.50 m below the sediment/water interface) was from the lowest datable sediment from a core 6.50 m in length taken with a modified Livingstone corer in a water depth of 2.30 m from "Hynes Cove Pond" (informal local name) (23 m), Triton Island, Notre Dame Bay, Newfoundland. The core consisted of gyttja (0-5.40 m), overlying clay-gyttja (5.40-5.515 m), separated by a 2 cm stony layer from a stony marine clay with shell fragments (5.535-6.50 m). Coring ceased at the limit of penetrability. The date marks the isolation of the lake after emergence and is minimal for deglaciation of the site. It is younger than dates on marine shells from sites on Triton Island (2.5 km to the southeast; 0.5 m; 11 500 ± 220 BP, GSC-2318, Blake, 1983) and Pilleys Island (5 km to the west-southwest; 27 m; 11 900 ± 200 BP, GSC-1505, Blake, 1983). It is also younger than a date indicating isolation of Gull Pond (52 m), Little Bay Island, 16 km to the northwest (12 000 ± 130 BP, GSC-4588) but is equivalent to GSC-4657 (11 100 ± 210 BP) from Leading Tickles site II, 16 km to the east-southeast. The pollen assemblage from the dated sediment is indicative of sedge-tundra; *Pediastrum* is abundant.

GSC-4588. Gull Pond 12 000 ± 130
$\delta^{13}C = -13.1‰$

The basal lake sediment (clay-gyttja) with a sparse herb—low shrub assemblage (identified by A.K. Dyer), sample LBIS 415-424, was collected by J.B. Macpherson on June 26, 1986 from Gull Pond, Little Bay Island, Notre Dame Bay, Newfoundland (49°38.6'N, 55°48.6'W), at an elevation of 52 m; submitted by J.B. Macpherson.

The sample (83.2 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.66.

The uncorrected age is 11 900 ± 130.

Comment (J.B. Macpherson): The dated sample was the lowest datable sediment (4.19-4.24 m below the sediment/water interface) from a core 4.32 m in length taken with a modified Livingstone corer in a water depth of 2.81 m. The core consisted of gyttja (0-3.98 m), overlying clay gyttja (3.98-4.24 m), the lowest segment of which was dated. The clay gyttja rested with a sharp transition upon stiff gritty clay with pebbles; the sequence may not be continuous. Coring ceased at the limit of penetrability. The site lies below the marine limit (100 m; Grant, personnal communication, 1989) and the date marks the isolation of the lake after emergence. The date agrees with dates on marine shells from Pilleys Island, 13 km southeast (11 900 ± 200 BP, GSC-1505, Blake, 1983) and Triton Island, 17 km southeast (11 500 ± 220 BP,

GSC-2318, Blake, 1983), and on basal organic lake sediment from Kings Point Springdale, 30 km southwest (11 800 ± 200 BP, GSC-3957, Blake, 1987). The pollen spectra of the dated sediment are similar to those from Kings Point, and are indicative of sparse herb-low shrub tundra. The date serves to confirm deglaciation and coastal emergence of Halls Bay between 12.0 and 11.0 ka.

GSC-4700. "Deer Cove Pond" 12 400 ± 110
$\delta^{13}C$= +0.8‰

The marine shells (*Hiatella arctica*; identified by D.R. Grant) were enclosed in clay/silt. Sample 88-GS-10 (Palaeontology Collection No. 104330) was collected by M. Milner on August 13, 1987, 0.95 km south of "Deer Cove Pond" (informal local name) fishing hamlet, near south end of "Normans Pond" (informal local name), on Baie Verte Peninsula, Newfoundland (50°0.55′N, 56°3.34′W), at an elevation of approximately 72 m; submitted by D.R. Grant.

The sample (51 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on two counts for 2740 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 400 ± 110.

Comment (D.R. Grant): The shells were juveniles 2-4 cm long with paired, but mis»ligned and slightly fractured valves. Their occurrence in stratified silt well above the local marine limit and between two dissimilar tills indicates that they date from an early higher marine submergence about 12.4 ka and were then overridden and deformed during a readvance of the local ice cap that is inferred for the uplands of Baie Verte Peninsula (Grant, in press). That readvance may correlate with the regional climatic reversal 10-11 ka (Mott et al., 1986) which caused the Ten Mile Lake readvance in northern Newfoundland (Grant, 1989b). The age and sedimentary sequence are difficult to reconcile with postglacial lake sediment at nearby Compass Pond which dated 11 700 ± 180 BP (GSC-3891, Blake, 1986), unless the freshwater date is slightly in error or because its higher elevation location was skirted by the glacier.

GSC-4192. Cat Arm River 8380 ± 100
$\delta^{13}C$= -23.8‰

The lake sediment (gyttja) sample CA 153-155 was collected by J.B. Macpherson on August 16, 1983 from Pond No. 8 in the Cat Arm Hydro Development, Cat Arm River, Northern Peninsula, Newfoundland (50°2.80′N, 56°49.30′W), at an elevation of 387 m; submitted by J.B. Macpherson.

The sample (12.8 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 3720 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.28.

The uncorrected age is 8370 ± 100.

Comments (J.B. Macpherson): The dated material was obtained from the base of a fresh cut in sediment located in a lake drained for hydro development. The basal gyttja was draped over boulders flooring the basin. The absence of fine mineral sediment and the shrub-tundra pollen assemblage of the dated sediment indicates that the date is minimal for deglaciation. This is the first date for the eastern part of the Northern Peninsula plateau and may be compared with other gyttja dates at the same latitude: GSC-4340 (11 100 ± 210 BP) on the western side and GSC-4393 (12 500 ± 120 BP) on the western lowlands.

GSC-4577. Bell Island 9870 ± 170
$\delta^{13}C$= -18.6‰

The lake sediment (clay-gyttja) with a sparse herb-dwarf shrub tundra assemblage (identified by J.B. Macpherson), sample GRIS 702-712 (B), was collected by J.B. Macpherson on July 7, 1987 from the largest lake on Bell Island, Newfoundland (50°46.08′N, 55°32.0′W), at an elevation of about 104 m; submitted by J.B. Macpherson.

The sample (133.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2150 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.36.

The uncorrected age is 9760 ± 170.

Comment (J.B. Macpherson): The dated sample was the lowest datable sediment (7.02-7.12 m below the sediment-water interface) from a core 8.00 m in length taken with a modified Livingstone corer in a water depth of 2.75 m from the largest lake on Bell Island, northern Newfoundland. There are some trees near the lake, but the island is essentially a tundra-covered plateau. The upper 4.00 m of the core consisted of organic sediment (30-40% loss on ignition); beneath this was clay-gyttja (4.00-7.12 m), the lowest part of which was dated, overlying clay (7.12-7.26 m) and sandy clay with scattered foraminifera. The base was hard. The site lies below the marine limit (130 m; Grant 1986a) and the date marks isolation of the lake following emergence. The date is not old enough to support the hypothesis that the Grey Islands lay beyond the Late Wisconsinan glacial limit (Grant 1977a) but neither does it argue against the hypothesis. The pollen spectra of the dated sediment indicate a sparse herb-dwarf shrub tundra. It is believed that the rapid mean accumulation rate above the dated sediment (0.07 cm/a) results from erosion of peat at the lake shoreline, which would have contributed to the unexpectedly high organic content of the top 4 m of the core.

Comment (D.R. Grant): The sequence corroborates inferences about the age and elevation of postglacial marine overlap and regression but unfortunately does not shed light on the question of Late Wisconsinan glacier extent.

GSC-4253. Crémaillière Hill pond 7000 ± 130
$\delta^{13}C = -28.0‰$

The lake sediment (gyttja) was underlain by grey sandy clay. Sample AP-4-85 (3.79-3.82 m in a 4.15 m core) was collected by T.W. Anderson on July 7, 1985 from Crémaillière Hill pond, about 4 km southwest of St. Anthony, Newfoundland (51°21.05′N, 55°37.10′W), at an elevation of 112 m; submitted by T.W. Anderson.

The sample (185 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7040 ± 130.

Comment (T.W. Anderson): The pond, at 116 m a.s.l., is below the local marine limit, which is 122 m a.s.l. (Grant, 1986a). The pond basin should have emerged from the sea at about 12 ka, according to marine shell dates on marine regression in the area (Grant, 1987b). The basal date suggests that up to 2-4 ka of unfavourable climatic conditions may have delayed the onset of organic deposition in the pond or the marine shell chronology could be too old by several thousand years.

GSC-4526. Old St. Anthony airport 8170 ± 110
$\delta^{13}C = -1.0‰$

The marine shells (*Spisula solidissima*; identified by D.R. Grant) were enclosed in sand. Sample 74-GS-04 (Palaeontology Collection No. 100968) was collected by D.R. Grant in July of 1974 on the site of the former airport, 22 km northwest of the town of St. Anthony, south coast of Pistolet Bay, Northern Peninsula, Newfoundland (51°29.54′N, 55°49.27′W), at an elevation of 7 m; submitted by D.R. Grant.

The sample (47.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 2450 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8180 ± 110.

Comment (D.R. Grant): The shells were in life position in the top metre of a sand blanket forming an extensive terrace, the lower edge of which was 5-8 m above sea level along southern Pistolet Bay. The shells were expected to date formation of the terrace and to give a maximum age of transgression, which cut its frontal scarp. The date is considerably older than the 7 m sea-level position, which is dated about 5.0 ka both by lake gyttja in emerged basins (Henningsmoen, 1977) and by shells in raised beaches (Grant, 1986a). The enclosing sediment is therefore assumed to have been deposited at approximately 10 m depth then later truncated during regression when the terrace was formed.

GSC-4859. Forked Feeder Pond 12 300 ± 100
$\delta^{13}C = +1.0‰$

The marine shells (*Hiatella arctica*; identified by D.R. Grant) were enclosed in till. Sample 71-GS-48 (Palaeontology Collection No. 100981) was collected by D.R. Grant in July, 1971, 12.8 km east-southeast of River of Ponds village, on western coastal lowland near Forked Feeder Pond, Newfoundland (50°30.28′N, 57°13.05′W), at an elevation of 85 m; submitted by D.R. Grant.

The sample (65 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on one count for 5190 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 300 ± 100.

Comment (D.R. Grant): The age is accepted as reliable because it accords with other shell-carbonate determinations in the area, and with a nearby postglacial gyttja date of 12 500 ± 120 BP (GSC-4393). It is thus believed to provide a close approximation of the actual time the calving front of the Northern Peninsula ice cap was situated on the western lowland. If other dates could be obtained from other De Geer moraines at other positions along the retreat line, they would help substantiate the hypothesis (as yet unproven in Canada) that such moraines are annual.

GSC-4538. Bateau Barrens 11 600 ± 90
$\delta^{13}C = +2.2‰$

The marine shells (*Mya truncata*; identified by D.R. Grant) were enclosed in sand. Sample 80.GS.50 (Palaeontology Collection No. 101031) was collected by D.R. Grant on July 17, 1980 from 6 km inland of the Gulf of St. Lawrence, 11 km south of the village of River of Ponds, in an area called Bateau Barrens, Northern Peninsula, Newfoundland (50°25.85′N, 57°24.48′W), at an elevation of 81-82 m; submitted by D.R. Grant.

The sample (40.3 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 600 ± 90.

Comment (D.R. Grant): The shells were juveniles 3-6 cm long, chalky, and in life position (with others: e.g., *Astarte*) in the top metre of a blanket of sand that forms an extensive depositional level at 75-80 m (Grant, 1986b). The age appears to date an 82 m sea level in this area (Grant, in press), judging by conformity with the general regressional trend outlined by dates nearby at higher and lower elevations (e.g., GSC-2919, Blake, 1983; GSC-3998, Blake, 1986). This date and the elevation of the sand plain suggest it may correlate with the "Bay of Islands surface" (Flint, 1940) — a prominent erosional shoreline in western Newfoundland, which Grant (in press) attributed to a geoidal stillstand, induced gravitationally by the Ten Mile Lake glacial readvance about 11.0 ka.

GSC-4393. "Portland Lake" 12 500 ± 120
$\delta^{13}C$= -24.3‰

The lake sediment (sandy gyttja) (sample AP-86-2; 772.5-776.5 cm in a 852 cm core) was collected by T.W. Anderson and R.J. Mott on August 6, 1986 from "Portland Lake" (informal local name), 11.2 km northeast of the village of Parson's Pond and 8.1 km southeast of the village of Portland Creek, Newfoundland (50°5.64′N, 57°35.35′W), at an elevation of about 100 m; submitted by T.W. Anderson.

The sample (224.4 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5640 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.26.

The uncorrected age is 12 500 ± 120.

Comment (T.W. Anderson): The sample dates the earlier of two organic intervals. The lower interval is believed to have been deposited during favourable climatic conditions. The overlying clay and sand denote deteriorating conditions prior to the onset of the postglacial warming with the deposition of gyttja. Compared with other lakes having the same sediment sequence in western Newfoundland (cf. GSC-4499), the 12.5 ka date on this lake could be too old by as much as 1000 years.

Comment (D.R. Grant): The site is a kettle (now about 20 m deep) in an interlobate moraine and is about 20 m below marine limit. Allowing time for the kettle to develop, the date may appear somewhat too old compared to shell ages, which show marine regression in progress by 12.8-12.0 ka (e.g., GSC-4381).

GSC-4407. St. Paul's hamlet 230 ± 70
$\delta^{13}C$= +3.2‰

The marine shells (*Mya arenaria*; identified by D.R. Grant) were enclosed in sandy gravel. Sample 86-GS-13 (Palaeontology Collection No. 104335) was collected by D.R. Grant on September 5, 1986 on the site of old St. Paul's hamlet, 1.8 km west-northwest of highway bridge over entrance to St. Paul's Inlet, west coast of Newfoundland (49°51.64′N, 57°49.48′W), at an elevation of 1.5-2.0 m; submitted by D.R. Grant.

The sample (42.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2510 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 180 ± 70.

Comment (D.R. Grant): The shells were separated valves, 4-8 cm long, slightly chalky but with smooth interior and associated with intact *Mytilus edulis*. They came from the middle one of 4-6 abandoned recurved spits, which lie between a fossil cliff and the modern storm beach ridge that is transgressing over them. The date is younger than expected but nonetheless provides a minimum age for a prominent low fossil cliff in western Newfoundland (Grant, 1989a), which evidently represents a Late Holocene sea-level fluctuation that was possibly due to passage of the collapsing crustal bulge (Grant, 1989b).

GSC-4340. Long Range Mountains 11 100 ± 210
$\delta^{13}C$= -24.4‰

The moss fragments (*Drepanocladus fluitans* (Hedw); identified by L. Ovenden) were enclosed in limnic silty brown clay extracted from the basal part of a 213 cm lake sediment core. Sample AP-86-6 was collected by T.W. Anderson on August 16, 1986 from an unnamed lake on the top of the Long Range Mountains, between Western Brook Pond and St. Paul's Inlet (Gros Morne National Park), 12 km southeast of St. Paul's village, Newfoundland (49°46.31′N, 57°41.45′W), at an elevation of 699.4 m; submitted by T.W. Anderson.

The sample (164.9 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.60.

The uncorrected age is 11 100 ± 210.

Comment (T.W. Anderson): This species of moss occurs in bogs and standing pools where it is often submerged at high water (Crum and Anderson, 1981). The date is substantially older than a similar basal lake sediment date of 7770 ± 190 BP (GSC-2483, Lowdon and Blake, 1979) from a pond at 678 m elevation on an interfluve (Big Level) south of Western Brook Pond.

GSC-4381. Western Brook shore 12 100 ± 100
$\delta^{13}C$= +2.7‰

The marine shells (*Chlamys islandicus*; identified by D.R. Grant) were enclosed in marine clay-silt. Sample 86-GS-31 (Palaeontology Collection No. 104340) was collected by D.R. Grant on September 19, 1986 from 0.8 km south-southwest along coast from the mouth of Western Brook, west coast Newfoundland (49°49.18′N, 57°51.65′W), at an elevation of 7-8 m; submitted by D.R. Grant.

The sample (42.8 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 100 ± 100.

Comment (D.R. Grant): The shells were intact paired juveniles 4-6 cm in diameter with blue nacreous interior and orange exterior. They occurred as a 20 cm layer between the till of a submarine end moraine of a Long Range outlet glacier and the overlying 2 m of deep water glaciomarine silt/clay beneath 2-3 m of sand/gravel of regressional beach ridges (Grant, 1989a). The date corroborates earlier dates greater than 12 ka from littoral sediment nearer the marine limit (cf. GSC-1485 and -1600, Lowdon et al., 1977) and thus gives a minimum age for the beginning of the postglacial marine incursion after the retreat from Piedmont Moraines, which is

estimated to be 12.7-12.8 ka (Grant, 1989b,). This date may suggest that GSC-4393 (12 500 ± 120 BP) on gyttja in a kettle in the moraine is a few centuries too old.

GSC-4391. "Green Garden" 13 400 ± 120
$\delta^{13}C$= +0.7‰

The marine shells (*Hiatella arctica*; identified by D.R. Grant) were enclosed in stony silt. Sample 86-GS-18 (Palaeontology Collection No. 104338) was collected by D.R. Grant on September 12, 1986 from 3.8 km northeast of Trout River wharf, at the south end of a marine terrace (locally called "Green Garden"), Gros Morne National Park, Newfoundland (49°30.47′N, 58°6.10′W), at an elevation of 12 to 15 m; submitted by D.R. Grant.

The sample (43.2 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 13 400 ± 120.

Comment (D.R. Grant): The shells were intact paired juveniles 1-3 cm with a smooth interior. The enclosing stony mud overlies till and underlies regressional gravel, which forms a gently sloping surface at 15-25 m, resembling a marine terrace. The shelly mud presumably represents deep water marine sedimentation, possibly approximating the time when the marine limit was registered nearby at 72 m. The date thus provides a minimum age for ice free conditions at this outer coastal location and is, as expected, only slightly older than the age of a nearby ice-marginal stand 2 km inland (GSC-2936, 12 500 ± 120 BP, Lowdon and Blake, 1980).

GSC-4659. "Long Pond" 8950 ± 100
$\delta^{13}C$= -21.3‰

The 752 cm lake sediment core showed fibrous basal gyttja overlain by fibrous gyttja and underlain by silty clay. Sample AP-85-11 (413-421cm) was collected by T.W. Anderson on July 17, 1985 from "Long Pond" (informal local name), 4.5 km northeast of Trout River, Gros Morne National Park, west coast of Newfoundland (49°29.66′N, 58°4.57′W), at an elevation of 200 m; submitted by D.R. Grant and T.W. Anderson.

The sample (139.6 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 3915 minutes (one 5 day) in the 2 L counter with a mixing ratio of 1.55.

The uncorrected age is 8890 ± 100.

Comment (D.R. Grant): The sample is the basal 7 cm of organic sediment and was intended to date the termination of dominantly mineralic sedimentation in this basin and thus provide a maximum age on deglaciation. The site is in an area of well graded colluvial slopes situated between two end moraines (Grant, 1989a) built by adjacent outlet glaciers. It was once thought to lie beyond the Late Wisconsinan stadial limit on morphostratigraphic grounds (Grant, 1977b), but the anomalous terrain maturity in this small area is now attributed to vigorous cryoturbation and solifluction acting on waterlogged soils that are not stabilized by vegetation because of the heavy metal content (Grant, 1987b). The date may therefore mark the transition from the intense periglacial climate of deglacial time to the modern conditions.

GSC-4553. Shoal Point 12 400 ± 140
$\delta^{13}C$= +4.6‰

The marine shells (*Chlamys islandicus*; identified by D.R. Grant) were enclosed in red silt. Sample 86-GS-14 (Palaeontology Collection No. 104336) was collected by D.R. Grant on September 10, 1986 from 2.0 km northeast of Norris Point ferry terminal, 0.9 km north of Shoal Point, Bonne Bay area, Newfoundland (49°31.91′N, 57°51.68′W), at an elevation of 30-37 m; submitted by D.R. Grant.

The sample (32.4 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2510 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 300 ± 140.

Comment (D.R. Grant): The shells were intact paired juveniles 5-8 cm wide with a nacreous interior and an original orange exterior in red silty mud underlying sand containing a shallower water assemblage (e.g., *Macoma, Mya*). The mud, derived from redbed source rocks 20 km southeast, is deep water sediment discharged by meltwater, possibly from a nearby ice front. In terms of sea level affinity, the deposit was laid down 10-20 m below local marine limit. The date reflects a diachronous marine incursion consequent on the glacial retreat up Bonne Bay fiord (Gros Morne National Park), being intermediate in age, elevation, and location between GSC-4391 (13 400 ± 120 BP) on the outer coast and GSC-1575 (10 500 ± 300 BP, Lowdon and Blake, 1973) at the fiord head.

Lomond Estuary Series

Two marine shell samples were collected by D.R. Grant on August 23, 1985 on the west side of Lomond River estuary, East Arm of Bonne Bay, Gros Morne National Park, west coast of Newfoundland (49°27.23′N, 57°45.10′W), at an elevation of 2 m; submitted by D.R. Grant.

GSC-4660. Lomond (I) modern

The marine gastropod shells (*Natica clausa*; identified by D.R. Grant) were enclosed in silt/clay. Sample 85.GS.34 (50.4 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on one count for 1370 minutes (one 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (D.R. Grant): The shells were well preserved with periostracum intact, along with *Macoma calcarea* and various other molluscs. The enclosing silty clay, with slightly wavy and contorted lamination was being actively eroded at tide level. It formed a ridge about 50 m long and 3 m high

that was situated about 20 m from the overgrown cutbank of an ice-contact marine gravel delta known to be underlain by thick plastic clay. The deposit was therefore believed to be the basal beds, which, as the delta was being cut back by modern wave erosion, had been squeezed out to the toe of the cliff by the overlying gravel load. The date, however, indicates that the sediment is modern, not part of the glaciomarine body. The size and stratification of the mass preclude emplacement by artificial means. It is therefore seen as a diapiric upbulge of the modern intertidal sediment caused either by extrusion of underlying older clays displaced by loading, or by lateral shoving during the movement of a nearby multi-ridged slump in the glacial clays (Grant, 1989a).

GSC-4790. Lomond (II) 11 200 ± 130
$\delta^{13}C = -1.0‰$

The marine shells (*Macoma calcarea*; identified by D.R. Grant) were enclosed in silt/clay. Sample 85-GS-34 (Palaeontology Collection No. 104342) (35 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 2235 minutes (one 2 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 200 ± 130.

Comment (D.R. Grant): The shells were well preserved with periostracum intact, along with *Natica clausa* (GSC-4660) and other molluscs. The enclosing red mud, being actively eroded at tide level, had wavy, contorted lamination and formed a ridge about 50 m long and 3 m high that was situated about 20 m beyond the foot of the overgrown cutbank of an ice-contact marine delta composed of 3-4 m muddy bottomset beds overlain by 20 m gravel foreset beds. The shelly ridge was therefore assumed to be the basal mud beds, which, as the delta was cut back by modern wave erosion, were squeezed out to the cliff foot by the overlying load. Although the age is difficult to reconcile with the modern age obtained on associated gastropods (see below) because both species were in the same strata, it is essentially what was expected as the time of ice retreat at this position. It is identical to that on shells (11 200 ± 150 BP, GSC-4279, Blake, 1988) in bottomsets of an analogous ice contact delta at the head of the other arm of Bonne Bay fiord, and it is what might be extrapolated for the head of the fiord, given that the glacier had retreated from the mouth of the fiord by 13 400 ± 120 BP (GSC-4391), and from midway up the fiord by 12 400 ± 140 BP (GSC-4553). As to whether the two 11.2 ka ages on adjacent ice-marginal positions are significant, they may reflect only the simple mechanics of a regular calving rate, or they may indicate an important stillstand/readvance of the Newfoundland ice sheet shortly after 11.2 ka (to allow for the transition from open marine sedimentation to burial by outwash). If so, the event may correlate with the 10.9-11.0 ka Ten Mile Lake readvance (Grant, 1989a) farther north on the island, which evidently resulted from a pronounced climatic deterioration in the region that lasted from about 11 ka to before 10 ka (Mott et al., 1986). Moreover, the accordant ages of the two fiord-head deltas confirm coeval marine limits of 38 m and 42 m; a dated relative sea level is thus established.

GSC-4400. Goose Arm 10 600 ± 100
$\delta^{13}C = +1.3‰$

The marine shells (*Mya truncata*; identified by D.R. Grant) were enclosed in stony mud. Sample 86-GS-39 (Palaeontology Collection No. 104341) was collected by D.R. Grant on September 28, 1986 from Goose Arm, Bay of Islands, Newfoundland (49°7.38′N, 57°55.95′W), at an elevation of 6 m; submitted by D.R. Grant.

The sample (54.3 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on one count for 5640 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 500 ± 100.

Comment (D.R. Grant): The shells were intact paired juveniles, 3-5 cm long in the uppermost 2 m of supposed bottomset beds. The beds outcrop on the eroded seaward face of an ice-marginal delta whose kettled topset beds are aggraded up to marine limit of about 60 m. In relation to GSC-868 (12 600 ± 170 BP, Lowdon and Blake, 1970), which is farther seaward, the date helps trace ice retreat in the Bay of Islands fiord system. It gives a minimum age for the ice-marginal stand, which, if allowance is made for the unknown thickness of underlying bottomsets, may relate to the Younger Dryas-age (about 11.0 ka) readvance and/or stillstand recognized in northern parts of the Newfoundland ice-cap complex (Grant, in press).

GSC-4281. "Squiggly Pond" bog 9050 ± 130
$\delta^{13}C = -28.3‰$

The 4.5 m core showed lake sediment (sandy gyttja) underlain by sand. Sample AP-13-85 (3.48-3.50 m) was collected by T.W. Anderson on July 28, 1985 from bog bordering "Squiggly Pond" (informal local name), 2 km southeast of York Harbour and 55 km northwest of Corner Brook, Newfoundland (49°2.78′N, 58°22.36′W), at an elevation of 52 m; submitted by T.W. Anderson.

The sample (168.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2550 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9100 ± 130.

Comment (T.W. Anderson): The lake basin is a kettle in a major end moraine that borders York Harbour. It formed after ice retreat and marine invasion of the outer coast by 12 ka (GSC-1462; Lowdon and Blake, 1973). Kettle lakes of this kind originate through the melting of stagnant ice (King, 1985). This date could therefore be a minimum of 2 ka younger than the regional deglaciation based on kettle versus non kettle basin dating in Saskatchewan.

GSC-4584. Piccadilly 13 000 ± 110
$\delta^{13}C$= -0.7‰

The marine shells (*Mya truncata* and *Macoma*; identified by D.R. Grant) were enclosed in gravel. Sample 85-GS-44 (Palaeontology Collection No. 104343) was collected by D.R. Grant on August 26, 1985 from a roadcut on Highway 463, 1.3 km north of stream mouth in village of Piccadilly, southwest side of Port au Port Bay, Newfoundland (48°34.20′N, 58°54.62′W), at an elevation of 14 m; submitted by D.R. Grant.

The sample (51.9 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 13 000 ± 110.

Comment (D.R. Grant): The valves were intact but were separate and chalky (associated with *Macoma* sp.). They were recovered from a pebble/gravel veneer over silty clay on a limestone knoll. The sequence records offlap conditions and the sediment is considered to be near-littoral. The age was intended to date the position of sea level intermediate between 41 m (shells: 13 600 ± 110 BP, GSC-2015, Lowdon and Blake, 1975) and tide level (peat: 12 700 ± 110 BP, GSC-4017, Blake, 1988). Together with an age of 13 345 ± 230 BP (S-3074) on a whalebone at 8 m (Grant, 1989a), the date tends to fit the reconstruction of (Grant 1987b, p. 49) who inferred a rapid emergence as in other west Newfoundland areas, better than that of Brookes et al. (1985) who depicted an anomalously slow and delayed emergence for this area.

GSC-4563. Fiods Cove 26 600 ± 550
$\delta^{13}C$= +2.5‰

The marine shell fragments (*Mya*, *Astarte*, and *Nuculana pernula*; identified by D.R. Grant) were enclosed in till. Sample 84-GS-65 (Palaeontology Collection No. 104327) was collected by D.R. Grant on July 24, 1984 from 2.8 km west of the junction of highways 460 and 463, at the head of Fiods Cove, north coast of St. Georges Bay on Port au Port Peninsula, Newfoundland (48°30.87′N, 58°57.43′W), at an elevation of 5-10 m; submitted by D.R. Grant.

The sample (16.6 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.62.

The uncorrected age is 26 600 ± 550.

Comment (D.R. Grant): The shells occurred only as sparse fragments up to 1 cm in size in an upper till that overlies contorted, brown, very compact, stratified sand with silt laminae. Beneath, a lower, more stony and compact, purplish till rests on limestone bedrock with striations pointing 217 degrees. The shells are inferred to date from a marine phase (possibly represented by the barren sands) prior to deposition of the surface till. If finite as stated, the date is the first to give a maximum age for the arrival of late Wisconsinan glaciers in the St. Georges Bay Lowland. A similar age and sequence occur at Codroy, 80 km to the southwest, where marine shells in a subtill gravel dated 33 790 ± 260 BP (TO-983) (Grant, 1990, Proudfoot et al., 1988).

GSC-4858. Romaines 12 800 ± 130
$\delta^{13}C$= + 1.9‰

The marine shells (*Hiatella arctica*, *Mya truncata*, and *Macoma calcarea*; identified by D.R. Grant) were enclosed in silt. Sample 85-GS-45 was collected by D.R. Grant on August 27, 1985, 0.7 km west of the mouth of Romaines River, near the village of Romaines, on the coast of St. Georges Bay, Newfoundland (48°33.22′N, 58°41.02′W), at an elevation of 6-8 m; submitted by D.R. Grant.

The sample (31 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 3810 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 700 ± 130.

Comments (D.R. Grant): The age is considerably younger than expected, given that a bowhead whale vertebra in the same silt bed yielded 13 345 ± 230 BP (S-3074) and shells in the overlying gravel layer gave 13 100 ± 180 BP (GSC-4095). This shell age was expected to approximate the bone age and thus support the general validity of early deglacial shell dates in western Newfoundland on which all glacial and sea-level reconstructions are based.

GSC-4685. Harbour Head
uncorrected 13 500 ± 120

The marine shells (*Mya pseudoarenaria*; identified by D.R. Grant) were enclosed in clay/silt. Sample 86-GS-07 (Palaeontology Collection No. 104332) was collected by D.R. Grant on September 2, 1986 from the north side of Harbour Head, 1.7 km northeast of the village of Highlands, St. Georges Bay, Newfoundland (48°11.04′N, 58°55.18′W), at an elevation of 1-3 m; submitted by D.R. Grant.

The sample (51.2 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on one count for 2710 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (D.R. Grant): The shells occurred both intact in life position and as separate valves but were fractured in place, in fine grained deep water sediment that overlies till and evidently forms the basal (bottomset?) facies beneath large conical cross strata of sandy gravel which resemble a deltaic forest structure (Grant, 1987b). An end moraine ridge has been constructed on top of the stratified sediments (Grant, 1989a) and may therefore either be directly related to the deltaic sequence or just a coincidentally situated younger feature. In either case, the marine beds represent deglacial marine invasion prior to a glacial readvance. The date therefore provides a maximum age for the resurgence, which, on the basis of similar lithology and stratigraphic position, has been correlated with the 12.7 ka Robinsons Head Readvance (Brookes, 1977). Moreover, the virtual similarity

of this age to others on correlative deep water beds in the area show that the marine incursion occupied a short time interval (cf. GSC-598, 13 420 ± 190 BP, Lowdon and Blake, 1968; GSC-4270, 13 600 ± 190 BP, Blake, 1988).

Anguille Mountains

Two age determinations were made on samples from the 300-302 cm interval in a 315 cm lake sediment core consisting of compact basal gyttja, sample AP-86-7 (107.0 g wet weight), that was collected from an unnamed lake on the top of Anguille Mountains, 7.2 km south of St. Fintan's, Newfoundland (48°6.92′N, 58°51.42′W), at an elevation of 413 m, by T.W. Anderson on August 17, 1986; submitted by T.W. Anderson.

GSC-4333. Anguille Mountains (I) 8000 ± 170
$\delta^{13}C = -30.5‰$

The sample was treated with hot base, hot acid, (noncalcareous) and distilled water rinses. The age estimate is based on two counts for 2500 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.88.

The uncorrected age is 8090 ± 170.

Comment (T.W. Anderson): The lake is ponded by an end moraine thought to mark the late Wisconsinan stadial limit (Grant, 1987b). Compared to other lake sites in the nearby lowland coastal areas of southwest Newfoundland, organic deposition was delayed in this lake for up to 2 ka possibly because of the presence of late ice and/or too severe climatic conditions at the top of the Anguille Mountains.

GSC-4333 BE. Anguille Mountains (II) 7190 ± 140
$\delta^{13}C = -27.6‰$

The hot base extract was precipitated with acid and rinsed with distilled water. The age estimate is based on two counts for 4220 minutes (two 2 day) in the 2 L counter with a mixing ratio of 2.14.

The uncorrected age is 7230 ± 140.

Comment (R. McNeely): The original sediment sample was inadvertently extracted with hot base (BE = base extract). In this case the base treatment extracted almost half of the organic carbon of the sample. We can compare the age of the extract with that of the residue. Although the age of the extract was expected to be younger than the residue, the age discrepancy was much larger than anticipated. The age of the bulk sample is between 7.2 and 8.0 ka and most probably 7.8 ka.

GSC-4735. Codroy Pond 3320 ± 70
$\delta^{13}C = -30.0‰$

The organic detritus was enclosed in sand. Sample 82-GS-107 was collected by D.R. Grant on July 4, 1982, 1.5 km from south end of Codroy Pond, where the forest access road crosses Crooked Brook, a tributary of Grand Codroy River, 0.3 km east of TransCanada Highway (48°2.87′N, 58°54.80′W), at an elevation of approximately 150 m; submitted by D.R. Grant.

The sample (210.0 g wet weight) was treated with cold base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1020 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3400 ± 70.

Comments (D.R. Grant): The site is located between two kame moraines built by a Long Range outlet glacier. The organic horizon lies about 1 m above present stream level at the contact of coarse cobble gravel (part of mapped outwash deposits) and 2 m of overlying sandy alluvium. The date was intended to bear upon the age of the ice marginal positions. However, its youthfulness suggests instead that the organic level relates to a much later period of postglacial alluvial and represents a brief, and possibly insignificant, cessation in the general aggradation of Late Holocene floodplain deposits.

GSC-3653. Loch Lomond 12 100 ± 200
$\delta^{13}C = -29.4‰$

The 674 cm lake sediment core shows gyttja underlain by sand. Sample AP-1-82 (318-325 cm) was collected by T.W. Anderson on August 8, 1982 from Loch Lomond, 45 km north-northwest of Port-aux-Basque and 3.4 km west of Tompkins, Newfoundland (47°48.25′N, 59°15.85′W), at an elevation of 74.2 m; submitted by T.W. Anderson.

The sample (142.5 g wet weight) was treated with hot acid (noncalcareous) and distilled water; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.31.

The uncorrected age is 12 200 ± 200.

Comment (T.W. Anderson): Pollen analysis was carried out on the core from 217 to 325 cm. The ^{14}C date occurs within the lowermost pollen assemblage zone (Zone 1) characterized by maximum percentages of *Salix* (willow), *Alnus* (alder), Gramineae (grass), *Artemisia* (sagebrush), and Cyperaceae (sedge) and rising values of *Betula* (birch). Zone 1 is succeeded by increasing percentages of *Picea* (spruce) (Zone 2). After reaching maximum percentages of about 36%, spruce declined abruptly and was replaced by birch. The *Picea* decline is estimated at about 9.6 ka based on studies elsewhere in the area. Based on a comparison with other sites in southwest Newfoundland, the Zone 1 assemblage is correlative with the Younger Dryas cooling (11-10 ka). The underlying sand unit probably represents the effect of increased upland glacial activity associated with the Younger Dryas climate reversal. Thus the 12.1 ka date may be too old by 1-1.5 ka.

Comment (D.R. Grant): The lake basin is floored by a till sheet, which overlies nearby shell bearing marine sediment dated at 14 100 ± 130 BP (GSC-4229; Blake, 1988) hence this date helps bracket the time of the last advance to the coast of the outlet glaciers from Long Range ice cap.

GSC-4652. Little Barachois 1200 ± 50
$\delta^{13}C$= -32.1‰

The basal salt marsh peat, sample 82.GS.106, containing *Juncus balticus* and *Argentina anserina* (identified by S.A. Edlund) was underlain by gravel and was collected by D.R. Grant on July 4, 1982 from shore of Little Barachois estuary, Cheeseman Provincial Park, 3.3 km east-northeast of Cape Ray lighthouse near Port aux Basques, southwestern Newfoundland (47°37.91'N, 59°15.90'W), at an elevation of 0.1 m; submitted by D.R. Grant.

The sample (325.8 g wet weight) was treated with cold base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2690 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 1310 ± 50.

Comment (D.R. Grant): Peat was the basal 5 cm of a 30 cm thickness of salt marsh peat that accumulated over a gravel outwash surface a relative rise of sea level (Grant, 1990). It consisted mainly of the roots and lower stem parts of two plants tolerate brackish water conditions, which presently grow at the innermost limit of the tidal marsh. The sediment thus marks the transition from marine to freshwater conditions. It is now 0.5 m below its original position. The date therefore approximates the initiation of high tide conditions 50 cm below its present level. It implies an average rate of sea-level rise of 4 cm/100 a and, although only a single determination for this area, compares with rates of 5-11 cm/100 a derived for neighbouring areas in southern Newfoundland (e.g., GSC-4670, 990 ± 80 BP; GSC-4292, 2110 ± 80 BP, Blake, 1988; Brookes et al., 1985; Grant, 1987b).

Labrador

GSC-4283. "Isabelle Lake" 10 300 ± 120
$\delta^{13}C$= -25.6‰

The 600 cm lake sediment core showed gyttja underlain by clay-gyttja and sand. Sample AP-7-85 (5.43-5.56 m) was collected by T.W. Anderson on July 11, 1985 from "Isabelle Lake" (informal name) about 6 km northwest of Red Bay, Labrador (51°44.77'N, 56°30.59'W), at an elevation of 163 m and submitted by T.W. Anderson.

The sample (201.8 g wet weight) was noncalcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 120.

Comment (T.W. Anderson): This lake basin appears not to be an ice block depression. The date could reasonably be 2 ka younger than the 12.5 ka isochrone (King, 1985) for deglaciation of this extreme southeast part of Labrador.

Forteau Series

Wood and shell samples from 2.5 km northwest of the Forteau town wharf, Forteau, Labrador (51°29'0"N, 56°58'30"W) at an elevation of 84 m, were collected by J.S. Thomson on October 20, 1984; submitted by D.G. Vanderveer.

GSC-4021. Forteau (I) 2460 ± 70
$\delta^{13}C$= -25.5‰

The wood (tree root or stem) (sample 19841020W-CRY; 3.3 g wet weight; *Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-12)) was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.59.

The uncorrected age is 2470 ± 70.

Comment (D.G. Vanderveer): This wood fragment is part of a collection that included shells and a partial skeleton of a walrus encountered during the excavation for a water line. The date of 2.5 ka is obviously too young for the age of emplacement of the shells (GSC-4175) and the walrus remains. The wood fragment probably represents part of a tree root that penetrated the site long after deposition and should therefore be discarded.

GSC-4175. Forteau (II) 10 400 ± 120
$\delta^{13}C$= +1.6‰

The marine pelecypod shells (sample 19841020S-CRY; 14.2 g dry weight; *Mya*; identified by D.G. Vanderveer) were treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.47.

The uncorrected age is 10 400 ± 120.

Comment (D.G. Vanderveer): These clam shells were part of a collection that included a fragment of wood and a partial skeleton of a walrus. The shells enable an accurate dating of both the emplacement of the walrus remains and the date of eustatic sea level of 84 m a.s.l. These shells provide a more definitive date for glaciomarine inundation, hence a minimum age of deglaciation, than those at Middle Bay (I-8365, 7220 ± 120 BP, Bigras and Dubois, 1987, p. 42), at Lac Salé (GSC-3325, 8390 ± 80 BP, Blake, 1983) or near Pinware (GSC-2825, 10 900 ± 140 BP at 9 m a.s.l., Lowdon and Blake, 1979). It is suggested that the Pinware sample (GSC-2825) is not representative of shoreline deposition at a mean sea level of 9 m a.s.l.

Delabarre Bay Series

A series of marine shell samples from the north shore of Delabarre Bay, northern Labrador, (59°2'N, 63°16'W), were collected by R.J. Rogerson and T. Bell on July 28, 1984 and August 11, 1985; submitted by T. Bell and R.J. Rogerson. An interpreted stratigraphic section of the sediments from which these marine shells were obtained appear in Bell et al. (1989).

GSC-3950. Delabarre Bay (I) 33 700 ± 710
$\delta^{13}C = +0.8‰$

The marine shells (sample 84072802; 47.0 g dry weight; *Mya truncata*; identified by W. Blake, Jr.), from an elevation of 4.0-5.0 m and enclosed in till, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 33 700 ± 710.

Comment (R.J. Rogerson): The sample was taken from a glaciomarine diamicton. Amino acid ratios were obtained from the University of Massachusetts: (AGL-479: 0.22 ± ? free, 0.039 ± 0.004 total).

GSC-4189. Delabarre Bay (II) 37 800 ± 1610
$\delta^{13}C = +1.2‰$

The marine shells (sample 85081110; 49.3 g dry weight; *Hiatella arctica*; identified by R.J. Rogerson) were taken from an elevation of about 2-3 m and were enclosed in yellow-brown sand with frequent pebbles to a silty-clayey matrix. They were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2520 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 37 800 ± 1610.

Comment (T. Bell and R.J. Rogerson): GSC-4189 was taken from a sand-gravel lag deposit overlying a glaciomarine diamicton. Amino acid ratios of 0.17 ± ? free; 0.039 ± 0.005 total (AGL-470) were obtained on shells from this unit.

GSC-4204. Delabarre Bay (III)

The marine shells (sample 85081120; 86.7 g dry weight; *Hiatella arctica*; identified by T. Bell), enclosed in bouldery, clayey mud at an elevation of 1.5-2 m, were treated with an acid leach to remove the outer 20% of the sample. Approximately one half of the sample was reacted for each fraction.

GSC-4204 OF. 38 900 ± 1420
$\delta^{13}C = +3.8‰$

The age estimate for the outer fraction (OF) is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 38 900 ± 1420.

GSC-4204 IF. 40 600 ± 1640
$\delta^{13}C = +0.1‰$

The age estimate for the inner fraction (IF) is based on one count for 5760 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 40 600 ± 1640.

Comments (T. Bell and R.J. Rogerson): GSC-4204 was collected from a glaciomarine unit, which is the western extension of the glaciomarine diamicton from which GSC-3950 was obtained. The presence of in situ and whole shells dated 33 ka in these samples demonstrate that this site was not overrun by grounded ice during the Late Wisconsinan. Shells from GSC-4204 had amino acid ratios of 0.18 ± 0.02 free and 0.043 ± 0.005 total (AGL-471).

GSC-4161. Adams Lake valley 9170 ± 100
$\delta^{13}C = +1.2‰$

The marine shells (barnacle fragments) (sample 85082107; *Balanus balanus*; identified by W. Blake, Jr.) were collected by T. Bell and R.J. Rogerson on August 21, 1985 from Adams Lake Valley, northern Labrador (59°1'N, 63°22'W), at an elevation of about 22 m; submitted by T. Bell and R.J. Rogerson.

The shell sample (24.1 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9150 ± 100.

Comment (T. Bell and R.J. Rogerson): This shell sample was collected below a prominent beach at approximately 25 m above sea level in Adams Lake valley; therefore, GSC-4161 dates a relative sea level greater than or equal to 25 m above present in outer Nachvak Fiord (Bell, 1987).

Ivitak Cove Series

A series of organic turf mat samples from Ivitak Cove, Nachvak Fiord, Torngat Mountains, Labrador (59°1'N, 63°46'W), at an elevation of 0 m, were collected by R.J. Rogerson on July 15, 1983; submitted by R.J. Rogerson.

GSC-3841. Ivitak Cove (I)
uncorrected 190 ± 90

The organic turf mat (sample IC/D; 12.5 g dry weight) was noncalcareous when treated with hot base, hot acid, and distilled water. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.84.

GSC-3863. Ivitak Cove (II)
uncorrected 180 ± 70

The organics from a turf mat (sample IC/G; 7.2 g dry weight; included *Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-24)) were noncalcareous when treated with hot acid and distilled water; base treatment was omitted. The age estimate is based on two counts for 2350 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.53.

Comment (R.J. Rogerson): GSC-3841 came from a turf layer buried beneath the contemporary gravel beach that is migrating inland, probably in response to recent relative rise

in sea level. GSC-3863 was taken from an eroded turf mat in the intertidal zone, approximately 10 m seaward from the beach. It provides evidence of recent marine transgression in Nachvak Fiord where the Holocene record is largely one of emergence.

Torngat Mountains Series

A series of humus-peat samples from Salermiut Range, Torngat Mountains, Labrador (59°37'N, 63°47'W), at an elevation of 2 m, were collected by D.J.A. Evans on August 2 and 8, 1983; submitted by R.J. Rogerson.

GSC-3832. Salermiut Range (I)
uncorrected 200 ± 60

The peat (sample 1B; 37.5 g dry weight; included *Salix* and *Betula*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-17)) was noncalcareous when treated with hot base, hot acid, and distilled water. The age estimate is based on two counts for 2140 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-3958. Salermiut Range (II)
uncorrected 80 ± 90

The humus-peat (sample 1E; 25.0 g dry weight) was noncalcareous when treated with hot base, hot acid, and distilled water. The age estimate is based on two counts for 2570 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (R.J. Rogerson): GSC-3832 was taken from a depth of 1.7 m below the surface of a gelifluction lobe and 2.5 m behind the lobe front. GSC-3958 was taken from a depth of approximately 80 cm below the surface of a gelifluction lobe and 1.25 m behind the lobe front. GSC-3832 was corrected for past changes in the $^{13}C/^{12}C$ ratios (Ralph et al., 1973) and ^{14}C levels (Stuiver and Pearson, 1986) to 300 ± 60 or 285 ± 60 years respectively. GSC-3958 was corrected for ^{14}C levels (Stuiver and Pearson, 1986) to 50 ± 90 years. Evans and Rogerson (1988) used these dates to estimate a gelifluction rate at approximately 8 mm/a for the past 400 years; somewhat higher than the average recent gelifluction rate described from elsewhere in the Canadian Arctic.

Nova Scotia

Bay St. Lawrence Series

A series of wood samples from a site on the coast of the Gulf of St. Lawrence, 1.9 km east of harbour entrance to Bay St. Lawrence, Cape Breton Island, Nova Scotia (47°0.75'N, 60°26.83'W), at an elevation of 8.0-10.0 m, were collected by R.J. Mott; submitted by R.J. Mott.

GSC-3864 HP. Bay St. Lawrence (I)
uncorrected >46 000

The wood (sample MS-82-22 No. 8 (F); *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 82-40)), enclosed in peat, under colluvium, was collected on June 27, 1982. The sample (45.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two (1 day) counts and one (3 day) count for 6380 minutes in the 5 L counter with a mixing ratio of 1.00.

GSC-4487 HP. Bay St. Lawrence (II)
uncorrected >49 000

The wood (sample MS-87-11; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 87-33)), enclosed in organic silt and peat, was collected on August 14, 1987. The sample (62.1 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 6550 minutes (three 2 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): Wood from this site was dated previously and produced a nonfinite age of greater than 38 300 BP (GSC-283) (Mott and Prest, 1967) and a finite age of 44 200 ± 820 BP (GSC-3636) (Mott and Grant, 1985). A Thorium/Uranium disequilibrium method age determination on wood from this site gave an age of 47 000 +4700 -4300 BP (UQT-178) (Mott and Grant, 1985; de Vernal et al., 1986). Two additional radiocarbon dates were attempted to validate the previous dates and both were nonfinite; greater than 46 000 BP (GSC-3864 HP) and greater than 49 000 BP (GSC-4487 HP). The latter dates suggest that the finite dates are spurious. It also limits the possible middle Wisconsinan age range to greater than 49.0 ka and lends more credence to the possibility that the site may date from a much older interval within the Sangamonian Interglaciation (*sensu lato*) (Mott and Grant, 1985).

Comment (D.R. Grant): The organic bed has a conformable and locally transitional contact with an underlying thin gravelly layer interpreted as beach sediment, which is concordant with a raised marine rock platform assigned to the marine transgressive maximum of the last interglaciation (Grant, 1988). The woody peat is therefore considered to date from the Late Sangamonian/Early Wisconsinan period of climatic cooling and sea level regression (Grant, 1987b, 1989b).

East Bay Series

A series of wood samples were collected by R.J. Mott and V.K. Prest on July 2, 1982; submitted by R.J. Mott. Quaternary deposits including organic sediments, and stratified as well as unstratified gravels overlain by till, were exposed in a sea cliff section along the north shore of East Bay, Bras D'Or Lake, Cape Breton Island, Nova Scotia (45°59'5"N, 60°27'50"W). The unconsolidated deposits overlie the irregular karstic surface of interbedded Mississippian gypsum and shale. A compact woody peat within a karst depression, woody and peaty layers, large logs

within thinly stratified silty clays and organic rich silts comprise three types of organic deposits within or beneath the unstratified gravels.

GSC-3871 HP. East Bay (I)
uncorrected >49 000

The wood (sample MS-82-36 W-2 (B); 45.0 g dry weight; *Tsuga canadensis*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-42)), enclosed in stratified clay and sand at an elevation of 1.0-2.0 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two 1 day counts and one 3 day count for 6640 minutes in the 5 L counter with a mixing ratio of 1.00.

GSC-3861 HP. East Bay (II)
uncorrected >50 000

The wood (sample MS-82-36 W-1 (D); 45.0 g dry weight; *Juniperus*; identified by R.J. Mott), enclosed in peat at an elevation of 1.0-2.0 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one 1 day count and one 4 day count for 6700 minutes in the 5 L counter with a mixing ratio of 1.00.

GSC-3878 HP. East Bay (III)
uncorrected >50 000

The wood (sample MS-82-33 A and D; 45.0 g dry weight; *Picea*; identified by R.J. Mott), enclosed in peaty gravel at an elevation of 2.0-3.0 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two 1 day counts and one 3 day count for 6390 minutes in the 5 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): The stratigraphy and nonfinite dates indicate that the nonglacial sediments, including the organic deposits, predate the Wisconsinan glaciation. Thorium/Uranium disequilibrium method age determinations on wood corroborate the pre-Wisconsinan age (Mott and Grant, 1985; de Vernal and Mott, 1986; de Vernal et al., 1986). Palynological results in conjunction with the stratigraphic framework and chronological control show that the organic deposits relate to a lengthy nonglacial period. An early altithermal interval (when climate was warmer than present and temperate forests contained thermophilous hardwood taxa) followed by an interval of mixed forests and climate similar to the present and then by a time of boreal forests and cooler climate, occurred in the area. Correlation with the Sangamonian Interglaciation (*sensu lato*), Stage 5 of the deep sea oxygen isotope record, is suggested (Mott and Grant, 1985; de Vernal and Mott, 1986).

Benacadie Point Series

A series of woody, silty peat samples enclosed in gravel and clay, from Benacadie Point, Bras D'Or Lake, Cape Breton Island, Nova Scotia (45°54.2'N, 60°43.7'W), at an elevation of 1.5 m, were collected by R.J. Mott on June 29, 1984; submitted by R.J. Mott.

GSC-3912. Benacadie Point (I) 10 900 ± 100
$\delta^{13}C$= -27.0‰

The woody, silty peat (sample MS-84-29 top 2 cm; 150.0 g wet weight), was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 5520 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 000 ± 100.

GSC-3900. Benacadie Point (II) 12 100 ± 100
$\delta^{13}C$= -25.7‰

The woody, silty peat (sample MS-84-29 basal 2 cm; 149.1 g wet weight), was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 200 ± 100.

Comment (R.J. Mott): This site was collected previously by R.H. MacNeill and D.R. Grant. MacNeill (1969) reported peat over bedrock, covered by a thin till and a bulk peat date of 11 670 ± 170 BP (I-3234). Grant (Lowdon and Blake, 1976) reported 30 cm of woody peat overlying sand covered by 2 m of till-like diamicton and a date of 11 300 ± 90 BP (GSC-2146) on a bulk peat sample. He suggested that unless a glacial readvance was invoked, the diamicton burying the peat could be explained as solifluction debris activated during a climatic reversion to periglacial conditions equivalent to the Younger Dryas.

Pollen analysis of this site shows shrub and herb dominated vegetation characterized the site as the climate warmed following deglaciation. The stratigraphy, chronology and palynology led Mott et al. (1986) to include this site with many others throughout the Maritimes representing a late-glacial climatic oscillation equivalent to the Allerod/Younger Dryas event of Europe.

Gillis Lake Series

A complete core of the postglacial organic sediment sequence was obtained from Gillis Lake, about 6.7 km east of St. Peter's, Cape Breton Island, Nova Scotia (45°39.7'N, 60°46.5'W). The lake surface is at an elevation of about 58 m. The site was previously reported on by Livingstone and Livingstone (1958) who completed a pollen study and dated the basal lake sediments (Deevey et al., 1959). The new core revealed the same sedimentary sequence reported by Livingstone and Livingstone and showed about 640 cm of organic lake sediments overlying sandy gravel. The base of the core showed silty gyttja becoming darker and more organic upward, a reversion to silty gyttja, followed by dark brown gyttja to the surface. The core was collected with a modified Livingstone corer by R.J. Mott and others on August 11, 1985; submitted by R.J. Mott.

GSC-4230. Gillis Lake (I) 12 000 ± 130
$\delta^{13}C$= -22.6‰

The organic lake sediment, grey gyttja (sample MS-85-14; 495-498 cm; 100.4 g wet weight), enclosed in silty gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2530 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 12 000 ± 130.

GSC-4246. Gillis Lake (II) 13 900 ± 160
$\delta^{13}C$= -24.9‰

The basal lake sediment (sample MS-85-14; 643-653 cm; 165.2 g wet weight), enclosed in clay and silty gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2310 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 13 900 ± 160.

Comment (R.J. Mott): The basal date of 13 900 ± 160 BP is similar to the basal date of 13 450 ± 260 BP (Y-525) reported by Deevey et al. (1959). Some carbonates in the sediment may mean that the age is anomalous because of the hardwater effect, but it is difficult to estimate the amount of error. The age of 12 000 ± 130 BP (GSC-4230) is also anomalous probably by about 1.0 ka judging by dates from other sites with similar stratigraphy and lithology (Mott et al., 1986). The pollen profile reported by Livingstone and Livingstone (1958) shows basal herbaceous spectra changing to shrub (especially shrub birch) dominated spectra as organic content increases. During the reversion to mineralogenic sedimentation, the spectra revert to herbaceous domination with less shrub birch. Overlying this zone, as the sediment becomes organic once again, shrub and tree pollen increase markedly. This level was dated at 10 160 ± 160 BP (Y-524) (Livingstone and Livingstone, 1958; Deevey et al., 1959). This sequence of change, both lithologically and palynologically, is comparable to numerous other sites throughout Nova Scotia and has been correlated with the Allerod / Younger Dryas event of Europe by Mott et al. (1986).

GSC-3880 HP. "Big Brook" site
uncorrected >52 000

Sample 83.65 (PL-83-26) was collected by S. Occhietti in July of 1983 from "Big Brook" site, Georgia Pacific Gypsum Quarry, near River Denys, Cape Breton Island, Nova Scotia (45°48′N, 61°13′W), at an elevation of 30.0 m; submitted by R.J. Mott. The wood used for dating (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-21)) was enclosed in silt. The organic silt formed a 2 m thick layer within several metres of diamicton overlying the gypsum bedrock. The lower diamicton was overlain by 1 m of gravel and two till units several metres thick.

The sample (47.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one 1 day count and one 4 day count for 6830 minutes in the 5 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): Pollen analysis of the organic silt above the dated wood shows spectra suggesting boreal to forest-tundra conditions prevailed at the time of deposition of the sediment. The spectra are similar to those found associated with two samples from other exposures in the quarry that were previously dated at 36 200 ± 1280 BP (GSC-3206) (Blake, 1984) and greater than 49 000 BP (GSC-3289) (Blake, 1982). The former date was on organic silt from beneath two tills and is considered spurious; the latter was wood accompanied by organic fragments from within the lower of two tills. The stratigraphy and pollen data suggest that the organic units at this site relate to a cool period probably occurring toward the end of the nonglacial interval predating Wisconsin glaciation (Mott and Grant, 1985).

Collins Pond Series

Organic sediment (peat) overlying till and overlain by diamicton was exposed in a coastal section near Collins Pond, about 2 km southwest of St. Francis Harbour, along the north coast of Chedabucto Bay, Nova Scotia (45°25.8′N, 61°20.3′W) (Stea and Mott, 1989). One exposure showed a compressed peat bed, bounded by thin layers of organic clay about 1-2 m above high tide level. The organic sediments rested on till and were covered by boulder gravel and diamicton in the bed of a small stream occupying the depression between drumlin ridges. The peat layer could be traced as a thin, uneven seam (less than 10 cm thick) up the flank of the adjacent drumlin where it was overlain by up to 2 m of diamicton. At the eastern end of the section, distorted and irregular bodies of peat and organic silt overlie till and are overlain and incorporated into a gravelly diamicton. Collected by R.J. Mott and R.R. Stea on September 4, 1986; submitted by R.J. Mott and R.R. Stea.

GSC-4475. Collins Pond (I)
uncorrected 10 900 ± 100

The peat and organic silt (sample MS-86-25 'thin seam'; Stop 151/86; 155.6 g wet weight), from a thin organic seam below diamicton at an elevation of 3.5 m, was enclosed in till and diamicton. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2740 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4367. Collins Pond (II)
uncorrected 11 800 ± 100

The peat (sample MS-86-25 'top 2 cm'; Stop 151/86; 103.9 g wet weight), from the top 2 cm of peat bed at an elevation of 1-2 m, was enclosed in till and colluvium. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4474. Collins Pond (III)
uncorrected 12 700 ± 130

The basal peat (sample MS-86-25; 'basal 2 cm'; Stop 151/86; 125.2 g wet weight), from basal 2 cm of peat bed at an elevation of 1-2 m, was enclosed in till and diamicton. The sample was treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 4230 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): The Collins Pond site has been interpreted by Stea and Mott (1989) as representing an interval following deglaciation when the climate ameliorated allowing vegetation to invade the area and organic sediments to accumulate, followed by climatic deterioration and renewed or revitalized glaciation of the area. Organic accumulation began about 12.7 ka (basal 2 cm of peat bed) and herb and shrub tundra-like vegetation characterized the site. This type of environment persisted until at least 11.8 ka (top 2=cm of peat bed). The thin organic seam that dated 10.9 ka has a somewhat different but still treeless pollen spectrum. The overlying diamicton has a distinct fabric, indicating the deposit is till emplaced by ice flowing from the east-northeast, opposite to the northwest-southeast fabric of the till forming the drumlins. The difference between the date at the top of the peat bed and that in the peat seam may be attributable to truncation of the peat bed by overriding ice.

GSC-4419 HP. "Moose Point" site
uncorrected >49 000

Sample PL-86-47 (Stop 155/86) was collected by R.J. Mott and R.R. Stea on September 5, 1986 from the "Moose Point" site, about 4 km east northeast of Guysborough along the north coast of Chedabucto Bay, Nova Scotia (45°24.1'N, 61°27.0'W), at an elevation of 3-4 m; submitted by R.J. Mott. The wood used for dating (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-15)) was enclosed in compressed peat and organic silt on the bedrock platform cut during the Sangamonian high sea level; Wisconsinan till(s) overlie the organic sediments.

The sample (53.1 g dry weight) was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on three counts for 4730 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): Pollen analysis indicates that northern boreal type vegetation prevailed in the area at time of deposition. Spruce (*Picea*) and jack pine (*Pinus banksiana*) were present along with abundant ferns (Polypodiaceae) and some grasses (Gramineae) and willow (*Salix*) in open areas. Toward the top of the sequence, spruce and pine decline and alder (*Alnus*) and herbs become more abundant. This site is one of a number of organic deposits underlying Wisconsinan till(s) that are dominated by boreal type pollen spectra that occur throughout Nova Scotia (Mott and Grant, 1985). These deposits are tentatively correlated with the upper part of stage 5, possibly substage 5a, of the oxygen isotope record.

Comment (D.R. Grant): This site, like Bay St. Lawrence (GSC-3864, -4487), is significant because it supports the assignment of the regional emerged rock platform to the Sangamonian stage sea level transgressive maximum (isotope substage 5e) (Grant, 1980a, 1989b).

Campbell Site Series

A series of moss and peat samples from the "Campbell" site, near Campbell Station, about 1.5 km south-southwest of Judique South, on coast of George Bay, Cape Breton Island, Nova Scotia (45°50'20"N, 61°29'40"W) were submitted by R.J. Mott.

GSC-3892. "Campbell" site (I) 10 800 ± 100
$\delta^{13}C$= -23.4‰

The moss (sample MS-82-39 'upper 2 cm'; 28.5 g dry weight), enclosed in sand, was collected by R.J. Mott on June 16, 1984, at an elevation of 5.0-6.0 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2380 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 100.

GSC-3781. "Campbell" site (II) 11 300 ± 100
$\delta^{13}C$= -28.5‰

The silty peat (sample MS-82-39; 6-7.5 cm; 91.1 g wet weight), enclosed in sand and clay, was collected by R.J. Mott and V.K. Prest on July 6, 1982 at an elevation of 5.0-10.0 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 400 ± 100.

Comment (D.R. Grant): Based on a previous date of 11 200 ± 110 BP (GSC-2212) the sequence was considered to record 'early late glacial deposition prior to reactivation of the glacier over southern Cape Breton Island' (Blake, 1984).

Comment (R.J. Mott): Pollen analysis indicates that treeless tundra-like vegetation dominated by shrub birch characterized the area as the climate warmed following deglaciation. Mineral sediment buried the site after 10.8 ka

when the climate cooled. Periglacial conditions prevailed during the cold interval and small local glaciers may have been reactivated or regenerated (Stea and Mott, 1989).

GSC-3848 HP. Addington Forks
uncorrected 36 100 ± 520

The wood used for dating (*Picea* or *Larix*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-30)) was enclosed in silt and clay containing a compact peat layer. This unit overlay till, probably of Illinoian age and was overlain by Wisconsinan till. Sample MS-81-21 "B" was collected by R.J. Mott and V.K. Prest on August 13, 1981 from about 0.75 km north of Addington Forks and 10 km southwest of Antigonish, Nova Scotia (45°34'N, 62°6'W), at an elevation of approximately 46 m; submitted by R.J. Mott.

The sample (45.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two 1 day counts and one 3 day count for 6380 minutes in the 5 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): Wood from this site, originally collected by MacNeill (1969) produced a finite age of 33 700 ± 2300 BP (I-3236). A second piece of wood subsequently collected by V.K. Prest produced a nonfinite age of greater than 42 000 BP (GSC-1598) (Lowdon and Blake, 1973). Mott and Prest re-examined the site in 1981 and a third age determination gave this date of 36 100 ± 520 BP.

Pollen analysis of the site allows correlation with other sites in Atlantic Canada related to the Sangamonian Interglaciation that have produced nonfinite dates greater than 50 000 BP (Mott and Grant, 1985). Since the site was exposed in a roadcut that was heavily overgrown with trees and shrubs, the wood may have been contaminated by modern rootlets, thereby producing a finite age. Therefore, GSC-3848HP is considered to be spurious.

Lismore Series

Peat samples, enclosed in sand, from the Lismore section, 1 km west of the village of Lismore, Northumberland Strait coast, about 24 km west-northwest of Antigonish, Nova Scotia (45°42.2'N, 62°16.7'W), at an elevation of approximately 4.6 m, were collected by R.J. Mott and R.R. Stea on August 13, 1985; submitted by R.J. Mott.

GSC-4156. Lismore (I)
uncorrected 10 500 ± 120

The sandy peat (peat fraction) (sample MS-85-19 top 2 cm; 17.7 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 3500 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 500 ± 120.

GSC-4153. Lismore (II)
uncorrected 11 900 ± 100

The sandy organic lake sediment (sample MS-85-19 "basal 2 cm"; 244.4 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Chance Harbour Lake Series

The series consists of seven lake sediment samples taken from a 9 m core from Chance Harbour Lake, about 6.5 km north-northeast of Trenton, Nova Scotia (45°40.2'N, 62°36.7'W) at an elevation of about 12 m. The deepest metre of the core shows 60 cm of clay between organic lake sediment. This clay layer was deposited during a period of slope instability. LECO analyses of the sediment indicate a high carbonate content for the three deepest metres of the sequence. Pollen analysis was done for the complete sequence (Jetté and Mott, 1989). The samples were collected by H. Jetté on August 13, 1985; submitted by H. Jetté.

GSC-4394. Chance Harbour Lake (I) 2920 ± 90
$\delta^{13}C$= -30.9‰

The organic lake sediment, brown gyttja (sample MS-85-16; 257.5-264.5 cm; 62.0 g wet weight), enclosed in gyttja, was treated with hot acid (noncalcareous), and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.64.

The uncorrected age is 3010 ± 90.

GSC-4388. Chance Harbour Lake (II) 4850 ± 70
$\delta^{13}C$= -31.1‰

The organic lake sediment, brown gyttja (sample MS-85-16; 409-411 cm; 10.0 g dry weight), enclosed in gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.17.

The uncorrected age is 4950 ± 70.

GSC-4382. Chance Harbour Lake (III) 7050 ± 100
$\delta^{13}C$= -31.0‰

The organic lake sediment, black gyttja (sample MS-85-16; 549-551 cm; 83.0 g wet weight), enclosed in black gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2070 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.18.

The uncorrected age is 7140 ± 100.

GSC-4573. Chance Harbour Lake (IV) 9220 ± 90
$\delta^{13}C$= -30.3‰

The lake sediment, black gyttja (sample MS-85-16; 654-660 cm; 193.6 g wet weight), enclosed in black gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2250 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9300 ± 90.

GSC-4274. Chance Harbour Lake (V) 11 300 ± 190
$\delta^{13}C$= -30.4‰

The lake sediment, black gyttja (sample MS-85-16; 748-754 cm; 170.2 g wet weight), underlain by silty clay, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.19.

The uncorrected age is 11 400 ± 190.

GSC-4267. Chance Harbour Lake (VI) 12 100 ± 120
$\delta^{13}C$= -31.5‰

The organic lake sediment (sample MS-85-16; 816.5-819.5 cm; 147.2 g wet weight), enclosed in silty clay and marl, was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5760 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.09.

The uncorrected age is 12 200 ± 120.

GSC-4328. Chance Harbour Lake (VII) 13 400 ± 160
$\delta^{13}C$= -34.1‰

The lake sediment, silt and organics (sample MS-85-16; 829.5-831.5 cm; 38.9 g wet weight), enclosed in marl and clay, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2590 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.41.

The uncorrected age is 13 600 ± 160.

Comment (H. Jetté): Analysis of this site has been undertaken to get a complete vegetational history for an area where a late-glacial climatic oscillation correlated with the European Allerod / Younger Dryas was well documented (Mott, et al., 1986). This oscillation has been recorded at Chance Harbour Lake. The clay layer represents a cold period (Younger Dryas) between two warm periods (Allerod and Holocene). Seven dates were obtained. GSC-4394 (2920 ± 90 BP) dates the arrival of beech (*Fagus* sp.), GSC-4388 (4850 ± 70 BP) dates hemlock decline (*Tsuga* sp.), and GSC-4382 (7050 ± 100 BP) dates hemlock arrival in this area. These three dates, from samples containing no carbonate, relate well with the regional palyno-chronostratigraphy of the Holocene (Anderson, 1985). GSC-4573 (9220 ± 90 BP) dates the arrival of pine (*Pinus*), GSC-4274 (11 300 ± 190), dates the beginning of the Holocene, GSC-4267 (12 100 ± 120 BP) dates the end of the Allerod, and GSC-4328 gives a minimum age for ice retreat. These four lower dates, from samples rich in carbonate, seem anomalously old. The arrival of pine for many lakes in Nova Scotia dates 8.5 ka (Ogden, 1987), the beginning of the Holocene should be 10.0 ka and the end of the Allerod should be 11.0 ka. The date for the ice retreat might also be too old. A difference of 1300 and 1100 is noted for GSC-4274 and GSC-4267. This discrepancy has been attributed mainly to the hardwater effect (Jetté and Mott, 1989).

Truro Series

A late-glacial buried organic deposit was exposed in a road cut during widening of Highway 102, 300 m north of Onslow Bridge over Salmon River, west of Truro, Nova Scotia (45°22.5'N, 63°19.3'W), at an elevation of 4-5 m above high tide level (Stea and Mott, 1989). The section showed organic sediment up to 50 cm thick overlain by 1-2 m of reddish-brown diamicton with a few boulders and underlain by reddish stony diamicton. The samples were collected by R.J. Mott and R.R. Stea on August 13, 1985; submitted by R.J. Mott.

GSC-4265. Truro (I)
uncorrected 11 400 ± 150

The sandy peat (sample MS-85-18 'top 1.5 cm'; 109.3 g wet weight) was overlain by red sand and diamicton and underlain by peat. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4297. Truro (II)
uncorrected 12 000 ± 120

The basal sandy and silty peat (sample MS-85-18 'basal 1 cm'; 106.7 g wet weight) was overlain by peat and underlain by sand. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 4140 minutes (three 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): The organic horizon represents a warming interval following deglaciation of the area prior to 12.0 ka when shrub and herb taxa indicative of tundra-like conditions with spruce beginning to invade characterized the area (Stea and Mott, 1989). Reversion of the climate after 11.4 ka, about 11.0 ka according to numerous other sites throughout the region (Mott et al., 1986), affected the vegetation, caused solifluction and mass wasting to increase, and possibly re-activated or caused renewed glaciation in some areas. The diamicton overlying the organic deposit suggests possible glaciation of the site (Stea and Mott, 1989).

Brookfield Series

A section through a bog and lake sediment sequence overlying varved clays and till was exposed during removal of overburden to expose limestone bedrock at the Maritime Cement, Canada Cement Lafarge Ltd., Atlantic Region Quarry, Brookfield, Nova Scotia (45°14′20″N, 63°20′35″W). The site is in the Shubenacadie River valley at an elevation of about 42 m a.s.l. The section was sampled by R.J. Mott and V.K. Prest August 15, 1981; submitted by R.J. Mott.

GSC-3635. Brookfield (I)
uncorrected 9140 ± 170

The wood (sample MS-81-25; *Abies balsamea*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-17)) was enclosed in algal gyttja. The sample (3.7 g dry weight) was treated with hot base, hot acid (noncalcareous) and distilled water rinses. The age estimate is based on two counts for 4180 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.57.

GSC-3652. Brookfield (II) 9780 ± 90
$\delta^{13}C$= -24.4‰

The lake sediment, algal gyttja (sample MS-81-25 A; 170.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9770 ± 90.

Comment (R.J. Mott): The difference in age of 640 years between the wood and enclosing gyttja emphasizes the possibility of obtaining an anomalous date from lake sediments even though free carbonates are not present in the sediment dated. At the Brookfield site, the bedrock is limestone and carbonates are present in the till, laminated sediments, and basal lake sediments indicating that carbonates were probably present in the basin at the time of deposition of the algal gyttja. Although dating was not attempted on the underlying sediments, the late-glacial climatic oscillation equivalent to the Allerod-Younger Dryas of Europe (Mott et al., 1986) is recorded at this site based on lithology and palynological studies.

Shubenacadie Series

A peat bed 10-12 cm thick beneath about 2 m of yellowish-grey sand was excavated by backhoe at the Shubenacadie Game Farm about 2 km northeast of Shubenacadie, Nova Scotia, (45°5.59′N, 63°23.36′W) at an elevation of 5-10 m (Stea and Mott, 1989). The fibrous sedge-moss peat near the base of the sand unit is known from boreholes in the area to overlie a thick deposit (up to 25 m) of reddish-brown clay over till (Hennigar, 1970). The sand surface is from 5-10 m above high tide level.

GSC-3981. Shubenacadie (I) 10 800 ± 100
$\delta^{13}C$= -27.2‰

The peat (sample 84.GS.90; *Picea, Pinus, Salix, Betula*; identified by R.J. Mott), enclosed in sand, was collected by D.R. Grant and R.R. Stea on November 19, 1984; submitted by D.R. Grant. The sample (85.0 g dry weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 100.

Comment (D.R. Grant): Originally discovered in subsurface by groundwater borehole testing, the organic bed was re-exposed and sampled by backhoe excavation; several monoliths were taken for analysis by R.R. Stea and D. Brett, Dalhousie University Palynology. The peat is very well preserved with many varied macrofossils; sand directly above is strongly reduced (H_2S odour and grey); the sand below is brown and oxidized. A peat horizon a few centimetres thick covers several hectares within a sand sequence of uncertain origin and the organic bed varies in depth, here about 2 m below surface and 20 cm thick. Evidently a large shrubby sphagnum bog was buried by extensive sand deposition either as sheet wash, fluvial incursion from nearby Shubenacadie River during extreme high stage, or even by marine overlap (although this is extremely unlikely). The organic bed is ostensibly the latest in a series of 10 occurrences of buried organic horizons, all of which date 10-12 ka and are believed to predate a sharp sudden climatic deterioration (Mott et al., 1986).

GSC-4337. Shubenacadie (II)
uncorrected 11 400 ± 100

The basal sandy peat (sample MS-85-17; base of peat), enclosed in sand, was collected by R.J. Mott and R.R. Stea on August 15, 1985; submitted by R.J. Mott. The sample (225.0 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (R.J. Mott): GSC-4337 dates the beginning of organic deposition at the site as the climate warmed following deglaciation (Stea and Mott, 1989). Pollen analysis indicates a change from a shrub-herb tundra-like environment to open spruce woodlands at the base of the peat. Near the top of the peat just prior to 10.8 ka spruce declined, and shrubs and herbs became more abundant. This trend records a climatic deterioration that continued until after 10.8 ka when sand covered the organic deposit. This deposit is similar in stratigraphy and chronology to numerous other buried organic sites throughout Nova Scotia and is related to the Allerod-Younger Dryas climatic oscillation of Europe (Mott et al., 1986). Stea and Mott (1989) postulate that the sand is outwash derived from re-activated or renewed glaciation in the uplands to the east.

Lantz Series

A late-glacial to early Holocene sedimentary sequence, discovered by R.R. Stea, was exposed in excavations (in Shaw's Brickyard) at the southern edge of the village of Lantz, Nova Scotia (44°58′40″N, 63°29′10″W), at an elevation of approximately 15 m (Stea and Mott, 1989). One exposure showed an organic layer 0-30 cm thick above or within a 35 cm thick, buff grey silty clay unit overlying about 1 m of orangish-brown sand and a thick deposit of reddish-brown, massive to varved clay. These sediments were overlain by reddish-brown, clay-rich diamicton of irregular thickness up to 2 m. Elsewhere at the site, grey clay with organic seams and sandy clay covered the basal reddish-brown clay, or the clay-rich diamicton. The samples were collected by R.J. Mott and V.K. Prest; submitted by R.J. Mott.

GSC-4042. Lantz (I) 9690 ± 110
$\delta^{13}C$= -28.0‰

The wood (sample MS-82-43; *Populus*; identified by R.J. Mott), enclosed in sandy clay, was collected on July 8, 1982. The sample (12.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2120 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.08.

The uncorrected age is 9740 ± 110.

GSC-3771. Lantz (II) 10 900 ± 90
$\delta^{13}C$= -28.4‰

The peat sample (MS-81-30 'A-top') enclosed in sand, was collected on August 19, 1981. The sample (119.7 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one 1 day count and one 3 day count for 5420 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 900 ± 90.

GSC-3774. Lantz (III) 11 700 ± 100
$\delta^{13}C$= -30.5‰

The peat (sample MS-81-30 'A-base', enclosed in sand, was collected on August 19, 1981. The sample (118.3 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one (3 day) count and one (1 day) count for 5250 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 800 ± 100.

Comment (R.J. Mott): Following deglaciation and prior to 11.7 ka, a glacial lake occupied the Shubenacadie River valley and deposited clay. Drainage of the lake exposed the sediments to erosion by the river, and organic deposits developed on the emergent areas between about 11.7 and 10.9 ka (Stea and Mott, 1989). Pollen analysis shows change from an early shrub dominated landscape to open spruce woodland as the climate warmed. Reversion to colder climate about 10.9 ka strongly affected the vegetation cover and shrubs, particularly shrub birch, and herbs were favoured, and the organic deposits were covered by mineral sediments of lacustrine or periglacial origin. Flood deposits of the Shubenacadie River containing organics with pollen spectra indicative of boreal forest and popular-aspen wood dating 9.7 ka record warming of the climate again in early Holocene time.

GSC-3963. Upper Economy 10 000 ± 130
$\delta^{13}C$= -27.4‰

The peat (*Picea, Betula, Salix*; identified by R.J. Mott (Palynological Report No. 84-6)) was enclosed in organic silt with wood. Sample 0-4-84 was collected by R.R. Stea on August 20, 1984 from 1 km west of Upper Economy along the Minas Basin coast, Nova Scotia (45°23.10′N, 63°51.05′W), at an elevation of 8 m; submitted by R.R. Stea.

The sample (50.9 g dry weight) was treated with hot base, hot acid (noncalcareous), and water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.53.

The uncorrected age is 10 000 ± 130.

Comment (R.R. Stea): The organic layer was found in a coastal exposure 4-8 m above HHW level. The layer consisted of peat with wood fragments 10 cm thick. It is underlain by a reddish, silty diamicton and overlain by 10 cm of gleyed silt, a 10 cm orange clay (Lepidocrocite) horizon, 20 cm of reddish silt, and 60 cm of gravelly sand. The organic horizon starts at the edge of a stream gully where it is overlain by the maximum thickness of gravel. From there it rises to 8 m where it pinches out at the surface along with the overlying sediments.

The underlying diamicton is probably a lodgement till. The organic layer has a pollen profile similar to that of buried late-glacial peat deposits that span a warm-cold interval equivalent to the Allerod / Younger Dryas of Europe (Mott et al., 1986). This peat, however, is 500 years younger. The anomalous date may be a result of the presence of modern rootlets within the sample. Alternatively, if the date is correct, the peat may simply be an allochthonous stream-lag or pond deposit of no regional climatic significance. The date, however, may serve as an indicator of the minimum age of deglaciation for the region. A diamicton, interpreted as till, overlies a peat bed with a 'top' date of 11.4 ka near Truro, Nova Scotia (Stea and Mott, 1989). It is interesting to note that this period, 11.0-10.0 ka, was the time frame for initial human occupation at Debert, near Truro.

GSC-4434. Welton Lake 9790 ± 110
$\delta^{13}C$= -30.0‰

An organic lake sediment sequence 1135 cm thick overlies clay in the lake basin. Sample MS-85-24 (1130-1135 cm) is the basal datable organic material. The core was collected by R.J. Mott on August 24, 1985 from Welton Lake, in Chebucto Game Preserve, about 15 km northwest of Parrsboro, Nova Scotia (45°29.5′N, 64°29′W), at an elevation of about 62 m; submitted by R.J. Mott.

The sample (128.9 g wet weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2200 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9870 ± 110.

Comment (R.J. Mott): The basal date indicates that organic deposition began in early Holocene time and a late-glacial climatic oscillation related to the Allerod-Younger Dryas event of Europe (Mott et al., 1986) is not recorded. This may indicate that the basin was not available for organic deposition earlier because of the presence of remnant glacial ice in the area. However, more work is required to substantiate this inference.

GSC-4639 HP. "Kenney Shore"

$\delta^{13}C$= -0.24‰

uncorrected >45 000

The marine shell (one valve) (*Mercenaria mercenaria*; identified by D.R. Grant) was enclosed in grey (marine?) mud. Sample 79-GS-150 (Palaeontology Collection No. 101125) was collected by D.R. Grant on July 29, 1979 from shore at the end of a sideroad signed "Kenney Shore", off Highway 101, 9 km north of the bridge at Weymouth, St. Mary's Bay, Nova Scotia (44°29.20′N, 65°57.98′W), at an elevation of 4-6 m; submitted by D.R. Grant.

The sample (185.4 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 2480 minutes in the 5 L counter with a mixing ratio of 1.00.

Comment (D.R. Grant): The sample was a single, massive, right-hand valve (10 cm x 9 cm x 1 cm thick) with a partly lustrous interior and a finely (glacially?) striated exterior. It occurred with similarly well preserved single valves of *Venericardia borealis* and *Ostrea virginica* in a 4 m thick bed of grey stony mud with wavy stratification, the upper 2-3 m of which has dark reddish-brown oxidation, ortstein layers, and manganese films along partings. The shell bed overlies a massive bright red-brown stony mud with fragmented shells; it is overlain by a surface mantle of unoxidized planar-bedded sandy gravel (Grant, 1980b). The lower unit resembles the Red Head Till and the surface unit is known to be a marine deposit of the Late Wisconsinan De Geer Sea in the Gulf of Maine. The purpose of the date therefore was to test whether the grey mud was deep water De Geer Sea sediment (of which no shell bearing facies has yet been found in this area) or whether it was equivalent to the Salmon River Sand, which has given various Middle Wisconsinan and older ages on different mollusc species at the type locality (GSC-1440, 38 600 ± 1300 BP and GSC-1701, 37 000 BP, Blake, 1984; L-1348A, 33 000 - 40 000 BP (Th/U)), but it assigned to the thermal maximum of the Sangamon interglaciation (isotope substage 5e) (Grant, 1987a). The fossil assemblage at this site is more temperate than the modern assemblage in this area and in that respect is like the Salmon River Sand. The age therefore permits the "Kenney Shore" bed to be considered correlative with the Salmon River Sand and thus interglacial in age.

GSC-4781. Bourneuf's Wharf 1670 ± 80

$\delta^{13}C$= +0.5‰

The marine "surf clam" shells (*Spisula solidissima*; identified by D.R. Grant) were enclosed in a surface accumulation underlain by marine gravel. Sample 79-GS-114 was collected by D.R. Grant on July 14, 1979 from the shore of St. Mary's Bay (Gulf of Maine), at Bourneuf's Wharf, 3.7 km north northeast of Church Point cathedral, Digby County, southwestern Nova Scotia (44°22.14′N, 66°5.69′W), at an elevation of 6.3 m; submitted by D.R. Grant.

The sample (82.1 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The treated sample (39.0 g) yielded 8.59 L of CO_2 gas. The age estimate is based on two counts for 2060 minutes in the 5 L counter with a mixing ratio of 1.00. The net count rate for the sample, and monthly backgrounds and standards were 23.036 ± 0.203, 2.172 ± 0.022, 28.325 ± 0.122 cpm, respectively.

The uncorrected age is 1660 ± 80.

Comment (D.R. Grant): The sample comes from the lower 10 cm of a deposit which covers about one hectare and averages about 0.5 m thick overlying emerged deglacial marine gravel. The date and the accompanying cultural material (stone implements, including a quartzite adze and slate scrapers) indicates that the deposit is a prehistoric Indian refuse heap or midden. A clay pipe stem (Dutch-type) in the upper 10 cm indicates that the site was in use until the early colonial period, although not necessarily continuously. The deposit probably correlates with a shell-heap near Yarmouth (also discovered by DRG) which gave an essentially concordant age of 1520 ± 60 BP and was tentatively assigned to the Maritime Archaic Complex (ancestors of the present Mic Mac aboriginal population) by Grant (1980b) on the basis of descriptions of several similar occurrences in southwestern Nova Scotia (Erskine, 1960).

New Brunswick

Sand Cove Series

Fine grained, organic sediment with matted moss layers up to 15 cm thick was exposed in a sea cliff along the Bay of Fundy, west of Sheldon Point at the end of Sand Cove Road (45°13.5′N, 66°7′W), on the southwest outskirts of St. John, New Brunswick. The site was discovered by A. Seaman (New Brunswick Department of Natural Resources and Energy). The exposure revealed a thin organic layer at about 8 m a.s.l. within a 2 m thick sandy gravel unit overlain by a thin surface peat and soil, overlying laminated marine clay that extended below sea level. The gravel unit and contained organic layer lies on the flank of the Sheldon Point moraine and was probably deposited in an estuarine environment as uplift occurred following retreat of the ice from the area (Stea,

1987, p. 43-48). The series of organic samples was collected by R.J. Mott and A. Seaman on June 6, 1984 and submitted by R.J. Mott.

GSC-4053. Sand Cove Road (I) 10 700 ± 120
$\delta^{13}C$= -28.6‰

The mossy organic debris, sample MS-84-1 basal 2 cm (291.7 g wet weight), was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 2400 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 120.

GSC-4055. Sand Cove Road (II) 10 800 ± 110
$\delta^{13}C$= -27.3‰

The organic silt and pebbles, sample MS-84-1 top 2 cm (402.8 g wet weight), was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 900 ± 110.

Comment (R.J. Mott): Dates GSC-4053 (10 800 ± 110 BP) and GSC-4055 (10 700 ± 120 BP) on the top and basal 2 cm of the organic bed, respectively, are essentially the same age and, along with a bulk sample date of 10 500 ± 200 (BGS-916) (A. Seaman, pers. comm., 1987), indicate that the organic layer represents a short interval of time. Pollen analysis shows a profile with abundant shrubs and herbs below rising values for *Picea* (spruce). Comparison with profiles from southern New Brunswick (Mott, 1975), corroborated by the dates obtained, suggest correlation with a late-glacial climatic deterioration between about 11.0 and 10.0 ka that has been equated to the Younger Dryas cooling of Europe (Mott et al., 1986).

GSC-3862. "Basswood Road Lake" (Splan Lake) 10 100 ± 130
$\delta^{13}C$= -26.4‰

The lake sediment (black laminated gyttja) (sample MS-78-3; 535-540 cm), was collected by R.J. Mott on August 8, 1978 from "Basswood Road Lake" (Splan Lake), about 8.0 km north-northwest of St. Stephen, New Brunswick (45°15.2′N, 67°20′W), at an elevation of about 106 m; submitted by R.J. Mott.

The sample (90.0 g wet weight) was noncalcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5760 minutes (one 4 day) in the 2 L counter with a mixing ratio of 2.34.

The uncorrected age is 10 100 ± 130.

Comment (R.J. Mott): This sample dates the base of the organic lake sediment sequence overlying the thick clay layer and organic sediments that represent the late-glacial climatic oscillation related to the Allerod-Younger Dryas event of Europe and the North Atlantic Ocean (Mott et al., 1986). Several samples from this site were dated previously to provide a chronological framework (Mott, 1975). This date provides an age for the continuation of organic sedimentation that began about 12.6 ka as the climate warmed following deglaciation but was interrupted by a reversion of climate at about 11.0 ka.

GSC-4199. Deersdale >36 000

The conifer charcoal (identified by R.J. Mott (unpublished GSC Wood Report No. 85-102)) was enclosed in a sandy diamicton. Sample 85 LFA 36-5 was collected by M. Lamothe on June 27, 1985 from 6 km southeast of Deersdale, New Brunswick (46°29′N, 67°1′W), at an elevation of 250 m; submitted by M. Lamothe.

The sample (6.8 g wet weight) was noncalcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.14.

Comment (R.J. Mott): The numerous small charcoal fragments were coniferous wood that could not be identified with certainty but may be pine (*Pinus* sp.?). Pollen analyses of associated organic horizons were barren or with poor pollen content. However, one sample did contain abundant Gramineae (grass) and Tubuliforeae (composite) pollen and minor amounts of *Pinus* (pine), *Alnus* (alder), *Betula* (birch), *Salix* (willow), Ericaceae (heath), *Artemisia* (sage), and Cyperaceae (sedge) (R.J. Mott, unpublished Palynological Report 87-15). Locally the vegetation was dominated by grasses and herbaceous plants indicating open conditions. Charcoal fragments suggest some trees were present, but a detailed environmental assessment cannot be made and no specific age relationship is apparent.

GSC-4261. Tantramar River 2550 ± 80
$\delta^{13}C$= -25.7‰

The wood (*Acer*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-24)) was overlain by tidal mud. Sample 80.GS.10 was collected by J.W. Griede and D.R. Grant on June 18, 1980 on the property of Radio Canada International Services, Tantramar River, New Brunswick (45°53.82′N, 64°19.40′W), at an elevation of 1.23 m; submitted by D.R. Grant.

The sample (31.5 g dry weight) was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on two counts for 2140 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 2560 ± 80.

Comment (D.R. Grant): The wood is from the base of a small tree trunk rooted in till, at a depth of 6.18 m below high tide level, and is overlain directly by salt marsh mud. Its age thus records the time of arrival of marine conditions caused by the ongoing Holocene subsidence-induced submergence. The average rate of relative sea-level rise over the last 25 centuries is thus 24 cm/100 a. This agrees with the average

rate over the last 4.0 ka determined from submerged forests (Grant, 1970), from basal peat (Noordijk and Pronk, 1981; Scott and Greenberg, 1983), and from salt marsh peat horizons in the tidal mud sequence (Amos, et al., 1980).

GSC-4277. Todd Mountain
uncorrected 11 500 ± 150

The organic silt (peat), enclosed in silt beneath about 2 m of diamicton, was seen in a backhoe excavation. Sample 86-LFA-0261-1 was collected by M. Lamothe on June 3, 1986 from Todd Mountain, 20 km west of Boiestown, New Brunswick (46°33′N, 66°41′W), at an elevation of 385 m; submitted by M. Lamothe.

The sample (500 g wet weight) was noncalcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5760 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (J.V. Matthews, Jr.): The plant and insect macrofossils from this site support the pollen evidence of tundra conditions. Among the plants are abundant achenes of the *Carex maritima* type and a few seeds of *Juncus* (unpublished GSC Plant Macrofossil Report 86-16).

The insect fauna is much richer (unpublished GSC Fossil Arthropod Report 86-15). Most of the fragments represent the ground beetle *Dyschirius nigricornis*, which is currently found across the north, both within and beyond treeline in peaty soil and boggy areas. Another ground beetle, *Elaphrus lapponicus*, also occupies damp, boggy areas near treeline. Several of the fossils (e.g., *Olophrum rotundicolle*, *Oloprhum boreale*, *Acidota quadrata*, and *Eucnecosum* sp.) represent the family Staphylinidae. The species in this sample can be found today around cool bogs in northern areas. None of the species in the genus *Eucnecosum* occur in lowland New Brunswick today, but like *Acidota quadrata*, some of them do have isolated populations on mountaintops or in the higher elevations of the Gaspé.

The most interesting insect fossil from the sample represents the rare subarctic/arctic beetle *Helophorus arcticus* Brown. *H. arcticus* presently lives in moist habitats near seashores and has been found with the pill beetle *Simplocaria*, fossils of which also occur in this sample. *H. arcticus* may require slightly alkaline or salty conditions as occur at sites near the sea. However, its fossils, as in this case, have been found at a number of inland sites.

Comment (R.J. Mott): Pollen analysis of the sample revealed an assemblage dominated by Cyperaceae (sedge) and *Salix* (willow) pollen accompanied by abundant Gramineae (grass), *Artemisia* (sage), and *Betula* (probably shrub birch) with a variety of other shrubs and herbs. Some *Picea* (spruce) and *Pinus* (pine) pollen was present along with minor amounts of other tree taxa. Tundra-like conditions are indicated with shrubs and herbs dominating around areas of sedge and grass covered wet areas; trees were probably present or were sparse (unpublished Palynological Report No. 87-5).

If the diamicton covering the organic unit is till then rejuvenation or reactivation of ice in the New Brunswick Highlands after 11.5 ka is inferred. Correlation of the organic unit with numerous other late glacial deposits of similar age throughout the Maritimes is suggested (Mott et al., 1986).

GSC-4493. Salisbury Bay 3630 ± 60
$\delta^{13}C$= -25.9‰

The basal wood (*Larix laricina*; identified by H. Jetté (unpublished GSC Wood Report No. 86-33)) was enclosed in peat. Sample MS-86-24 was collected by R.J. Mott and H. Jetté on August 10, 1986 from about 8.5 km east-northeast of Alma, along coast of Salisbury Bay, Chignecto Bay, New Brunswick (45°37.7′N, 64°50.3′W), at an elevation of about 7 m; submitted by R. McNeely.

The sample (38.6 g dry weight) was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on two counts for 2430 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3650 ± 60.

Comment (R.J. Mott): Kettle holes developed on the surface of a delta composed of sand and gravel have been infilled with organic sediments. The delta relates to a former higher sea level. The sample comes from near the base of the peat unit overlying lake sediments (gyttja) and dates incursion of a woody bog into the depression occupied by a shallow lake.

Comment (R. McNeely): This material was collected by R.J. Mott to provide crosscheck material for the Radiocarbon Dating Laboratory at GSC. Subsamples of this material have been dated by the Laval Radiocarbon Dating Laboratory with good results (personal communication M. Allard, 88.06):

1st preparation (2.0 g C) - 3530 ± 90 BP
2nd preparation (1.8 g C) - 3750 ± 120 BP
(1.6 g C) - 3750 ± 130 BP.

Subsamples of sound, dry wood are available for crosscheck dating purposes, in 50 g quantities, by writing to:
Chairman, Geochronology Committee,
Terrain Sciences Division,
Geological Survey of Canada,
601 Booth Street, Ottawa, Ontario
K1A 0E8 CANADA

Québec

GSC-4278. "Triangle Lake" 8970 ± 120
$\delta^{13}C$= -23.6‰

The lake sediment, gyttja was underlain by alternating sand, gravel, and sandy clay. Sample AP-6-85 (148-150 cm) was collected by T.W. Anderson on July 10, 1985 from "Triangle Lake" (unofficial name), about 16 km northwest of Blanc Sablon, Québec (51°30.41′N, 57°18.81′W), at an elevation of 141 m; submitted by T.W. Anderson.

The sample (91.5 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8950 ± 120.

Comment (T.W. Anderson): The lake basin is a kettle in the Bradore Moraine, a major end moraine in the southeast Québec - Labrador region. The basin probably formed by the melting of stagnant ice; the date is 2.2 ka younger than a similar basal date (GSC-4283) in a nearby lake that probably did not originate as an ice block depression. The date therefore could reasonably be up to 3.5 ka younger than the 12.5 ka isochrone drawn at the Bradore Moraine (King, 1985).

GSC-4276. "Three-Lobe Lake" 8100 ± 160
$\delta^{13}C$= -24.7‰

The lake sediment, gyttja was underlain by clay-gyttja. Sample AP-5-85 (228-233 cm) was collected by T.W. Anderson on July 9, 1985 from "Three-Lobe Lake" (unofficial name), about 14 km northwest of Blanc Sablon, Québec (51°29.38′N, 57°23.49′W), at an elevation of 129 m; submitted by T.W. Anderson.

The sample (198.4 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8090 ± 160.

Comment (T.W. Anderson): The lake basin is a kettle in Belles-Amours Moraine, a major end moraine in the southeast Québec - Labrador region. The kettle basin probably originated by the melting of stagnant ice and is 2.2 ka younger than a basal date (GSC-4283) from a nearby lake that is probably not an ice-block depression. The date could reasonably be 3.0 ka younger than the 11.0 ka isochrone drawn at the Belles-Amours Moraine (King, 1985).

GSC-4321. Grande-Vallée River 12 200 ± 200
$\delta^{13}C$= +1.7‰

The marine shell fragments (unidentified) were enclosed in silty sand. Sample 86-VJ-11 was collected by J.J. Veillette on July 25, 1986 from west of Grande-Vallée village, about 500 m from seashore, in a bay formed by Grande-Vallée River, Gaspésie, Québec (49°13′28″N, 65°8′21″W), at an elevation of 12 m; submitted by J.J. Veillette.

The sample (8.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 4090 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.93.

The uncorrected age is 12 200 ± 200.

Comment (J.J. Veillette): The dated shell fragments suggest that the enclosing sediments were reworked and overridden by a local glacier, in the Grande-Vallée River valley. The age indicates that local glaciers were still present in the interior of the peninsula for 1000 years or more following the maximum Goldwait Sea transgression.

Iles de la Madeleine Group

The following age determinations were made in support of a study by R.J. Mott, D.R. Grant, and L.A. Dredge of two main lithostratigraphic complexes. The older group of six sequences, of which four are isotopically dated, features assemblages of temperate-climate, Sangamonian-age organic sediment that is interbedded with littoral deposits and overlain by till and various other sediments. The younger group (three dated sites) includes Late Wisconsinan peaty sediment overlain by diamicton, etc., as well as Holocene surface peat, which has accumulated in gypsum sinkholes. These sedimentary sequences are the basis for a reconstruction of the main paleogeographic events in the central Gulf of St. Lawrence area during the last 125 ka (Grant et al., in press).

Pointe du Sud-Ouest Series

A series of peat samples from Ile d'Entrée, halfway between Pointe du Sud-Ouest and the Navigation Light, Iles de la Madeleine, Québec (47°16.0′N, 61°42.7′W), at an elevation of 2 m, were collected by R.J. Mott and L.A. Dredge on August 19, 1987; submitted by R.J. Mott.

GSC-4779. Pointe du Sud-Ouest (I) 4450 ± 60
$\delta^{13}C$= -29.1‰

The peat (sample 87 MS-31; Entry-15; 80.0 g wet weight), was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 3910 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4510 ± 60.

GSC-4794. Pointe du Sud-Ouest (II) 9000 ± 90
$\delta^{13}C$= -28.0‰

The peat sample 87 MS-31 (Entry)-10 (20.4 g dry weight), was treated with cold base, hot acid (noncalcareous) and distilled water rinses. The age estimate is based on two counts for 2205 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9040 ± 90.

GSC-4574. Pointe du Sud-Ouest (III) 11 600 ± 150
uncorrected

The peat (sample 87 MS-31; Entry; 432.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 3940 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.37.

Comment (R.J. Mott and L.A. Dredge): Peat was exposed in a coastal section of a karst depression. About 230 cm of woody peat overlies about 25 cm of clayey gyttja, 30 cm of clay with organic seams, about 50 cm of reddish-grey bouldery rubble, 30 cm of purplish-red clay, and about 25 cm of grey silt with organic seams. This whole sequence overlies orange sand that extends an unknown depth below beach level. On the left side of the exposure the peat is much thicker and its base is below sea level. The underlying sediments dip steeply below the peat indicating active karst subsidence since these sediments were deposited.

The stratigraphy and lithology suggest that the late-glacial climatic oscillation recorded at numerous sites throughout Atlantic Canada is represented at this site which is within 100 m of a buried organic deposit that relates to the early warm interval as well. This basal date confirms the chronology of the site and relates the basal organic sediment to the warming interval prior to reversion of the climate that is represented by other overlying reddish clay and rubble units.

Ile d'Entrée Series

Three samples from a buried organic bed exposed 3-4 m above high tide level in a sea cliff on the south coast of Ile d'Entrée, Iles de la Madeleine, Québec, 1.1 km south-southeast of the main wharf (47°16.09'N, 61°42.74'W). Banded peat and sandy peat 50 cm thick overlie orange sand with reddish diamicton seams and are overlain by about 50 cm of orange sand and 60 cm of red sandy diamicton. The samples were collected on June 23, 1982 by R.J. Mott and V.K. Prest; submitted by R.J. Mott and D.R. Grant.

GSC-3699. Ile d'Entrée (I) 10 600 ± 100
$\delta^{13}C$= -27.9‰

The peat (sample MS-82-19 'top'; 132.8 g wet weight) was obtained from the top 1 cm of the peat bed. The sample was treated with hot base, hot acid (noncalcareous), and distilled water. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 100.

GSC-3657. Ile d'Entrée (II) 11 100 ± 70
$\delta^{13}C$= -27.3‰

The peat (sample MS-82-19; 149.4 g wet weight) was obtained from below contact of banded peat and sandy peat. The sample was treated with hot base, hot acid (noncalcareous), and distilled water. The age estimate is based on two counts for 2380 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 200 ± 70.

GSC-3696. Ile d'Entrée (III) 11 300 ± 110
$\delta^{13}C$= -27.2‰

The peat stringers in silty clay (sample MS-82-19 'base'; 394.4 g wet weight) were obtained from the basal 2 cm of the peat bed. The sample was treated with hot base, hot acid (noncalcareous), and distilled water. The age estimate is based on three counts for 3390 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 300 ± 110.

Comments (D.R. Grant and R.J. Mott): The deposit follows a phase of mineralic sedimentation and records a short interval of organic sedimentation in a shallow pond/wet sedge meadow environment that was eventually buried by muddy diamicton of problematic origin. Pollen spectra, based on analyses at 14 levels in this 50 cm bed, represent shrub-tundra-like vegetation, which responded only slowly to a gradually improving climate, perhaps because of the maritime setting and long sea-ice season.

At about 11.0 ka, a climatic deterioration interrupted the warming trend and adversely affected the distribution and abundance of most taxa. The surface diamicton may be colluvium shed from slopes destabilized by thinning vegetation. The sequence is correlated with a group of more than 20 others of comparable age and stratigraphy in the Atlantic Provinces region (Mott et al., 1986) apparently representing a climatic reversal equivalent to the European Allerod-Younger Dryas oscillation, which is linked to a southward shift of the oceanic Polar Front.

GSC-4533. Ile du Havre aux Maisons 1540 ± 80
$\delta^{13}C$= -26.6‰

The peat was enclosed in peat and sand. Sample 87 MS-33 (Thériault) 'base' was collected by L.A. Dredge and R.J. Mott on September 23, 1987 from 0.8 km northeast of the airport control tower at the north end of Ile du Havre aux Maisons, Iles de la Madeleine, Québec (47°25.7'N, 61°46.1'W), at an elevation of 1 m; submitted by R.J. Mott and L.A. Dredge.

The sample (75.0 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2520 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.37.

The uncorrected age is 1570 ± 80.

Comment (D.R. Grant and L.A. Dredge): The peat is the base of a sphagnum bog covering inner older, partly submerged beach ridges, which have prograded seaward from a fossil rock cliff to form the Dune du Sud barrier-tombolo complex. Ridges and bog are now being eroded in the tidal zone. The fossil beaches were built when

sea level was at least 5 m lower, assuming they were originally 5 m above tide level, like the present beach. Bog growth presumably reflects paludification of sandy terrain as the groundwater table was elevated by rising sea level. The age therefore provides a general minimum date for early beaches and a slightly lower sea level. Allowing for uncertainty as to whether peat overlies crest or swale, assuming that peat accumulation lagged ridge abandonment, and allowing time for earlier ridges to form, the inception of the barrier complex is estimated at 2.0 ka. The fossil cliff, which marks the Holocene transgressive maximum, is therefore older, perhaps 2.5 ka. The age accords with Late Holocene submergence measured in nearby southwestern Newfoundland (GSC-4652).

GSC-3633. Baie de Plaisance
uncorrected >47 000

The wood was enclosed in peat, under till(s). Sample MS-82-13 was collected by D.R. Grant and R.J. Mott on June 22, 1982 from 0.4 km northwest of Havre Aubert crossroads, Iles de la Madeleine, on the sea coast of Baie de Plaisance, Québec (47°14.30'N, 61°50.86'W), at an elevation of approximately 4 m; submitted by R.J. Mott and D.R. Grant.

The sample (45.0 g dry weight) was treated with hot base, hot acid (noncalcareous) and distilled water. The age estimate is based on two 1 day and one 3 day counts for 6630 minutes in the 5 L counter with a mixing ratio of 1.00.

Comments (D.R. Grant and R.J. Mott): The wood came from the lower part of a 1.5 m thick peat bed, which accumulated with other sediments as a sinkhole developed in Carboniferous gypsum flanked by andesite. The marginal part of the sequence was undisturbed on the volcanic bedrock. The paleodepression is infilled first with andesite rubble, then by sand and peat up to the lip of the volcanic-rock knoll, about 5 m above tide level. Overlying the sand-peat layer was 3 m of white sand, 2 m of compact purplish till, and 4 m of sandy substratified stony diamicton (also considered to be till) which resembled the so-called Demoiselle Drift of Prest et al. (1976). Pollen analysis of the organic part of the sequence shows an assemblage dominated by *Picea*, *Pinus*, and *Alnus*. The climate was evidently similar to present conditions and hence was interglacial in character, but it was not as temperate as the altithermal phase recorded at Portage du Cap (Prest et al., 1976) and at Le Bassin. The deposit is therefore referred to a latter, slightly cooler part of the Sangamonian Stage. The overlying tills thus demonstrate Wisconsinan glaciation.

GSC-4569. Le Bassin bog
uncorrected 9480 ± 130

The peat sample 87 MS-25 (Baie du Bassin) was collected by R.J. Mott and L.A. Dredge on September 17, 1987 from east end of Le Bassin, Ile du Havre Aubert, Iles de la Madeleine, Québec (47°13.5'N, 61°51.7'W), at an elevation of about 0 m; submitted by R.J. Mott and L.A. Dredge.

The sample (49.7 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.54.

Comment (R.J. Mott and L.A. Dredge): Peat was exposed in a coastal section through a karst depression. Organic sediments extend below sea level with about 225 cm of peat overlying approximately 20 cm of grey silty clay and fibrous sedgy peat. This sequence overlies basal grey silty and buff-grey silt/fine sand.

Early Holocene date is somewhat younger than expected for this site where the lithology and stratigraphy suggested that the late glacial climatic oscillation, represented in the Magdalen and at numerous other sites in Atlantic Canada, would be recorded. Either this site does not include the late-glacial part of the record, or it was not possible to excavate deep enough because of the water table.

GSC-3623 HP. Le Bassin
uncorrected >46 000

The wood was enclosed in peat. Sample MS-82-4 was collected by D.R. Grant and R.J. Mott on August 19, 1982 from west shore of lagoon called Le Bassin 4.7 km west of Havre Aubert town, Ile du Havre Aubert, Iles de la Madeleine, Québec (47°14.00'N, 61°53.97'W), at an elevation of about 1 m; submitted by R.J. Mott and D.R. Grant.

The sample (45.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water. The age estimate is based on two 1 day and one 3 day counts for 6460 minutes in the 5 L counter with a mixing ratio of 1.00.

Comments (R.J. Mott and D.R. Grant): The sample of wood (*Pinus strobus*) came from a 20 cm thick layer of compact peat that was sandwiched between sand and 1 m of silty clay, and overlain by 4 m of gravel, till, and substratified diamicton (Grant, 1987a). Pollen, micro-, and macrofossils in the sand-peat-clay sequence document a transition from lacustrine to lagoonal conditions during a gradually warming climatic trend, which culminated in an altithermal phase with more favourable conditions than now prevail on the islands. In view of additional age determinations using the Th-U disequilibrium method: (106 400 ± 8400 BP (UQT-183), 101 700 ± 17 000 BP (UQT-182) and 89 000 ± 8000 BP (UQT-184)), the sequence evidently records a thermal optimum followed by a marine transgression which deposited littoral gravels (Grant et al., in press). The organic interval is therefore assigned on ecological grounds to the warmest part of the last interglaciation (Sangamonian Stage), *i.e.*, to oxygen-isotope stage 5e, or approximately 125 ka (Mott and Grant, 1985).

GSC-4633 HP. Portage-du-Cap
uncorrected 42 900 ± 720

The fragmented marine shells were enclosed in sand. Sample 87-DU-0?? was collected by L.A. Dredge and R.J. Mott on September 9, 1987 from a sand and gravel pit

about 0.8 km south of Portage-du-Cap, Ile du Havre Aubert, (47°14'N, 61°54'W) at an elevation of about 2 metres; submitted by L.A. Dredge and R.J. Mott.

The sample (200.4g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 8540 minutes in the 5-L counter with a mixing ratio of 1.00.

Comments (R.J. Mott): The shell sample was collected from sand in a pit behind the coastal section at Le Bassin site which exposed an interglacial peat bed (Mott and Grant, 1985). The peat bed, with pollen and macrofossils indicative of climate considerably warmer than present in the area, overlies sand and is overlain by marine clay/silt and interfingered gravel and sand which contained the shells. A silty clay till that grades upward into a sandy till overlies the gravel and sand (Grant et al., in press). *Macoma calcarea* shells in life position comprised the bulk of the sample, but a few shells of *Ostrea virginica* (oyster) and *Balanus* sp. (barnacle) were present. Grant et al. (in press) interpret the sediments between the peat bed and the overlying till as having been deposited as the sea rose over the site to its high interglacial level. U-Th series dates on wood from the peat bed corroborate the interglacial age (Mott and Grant, 1985). Therefore, this finite date is considered to be anomalous and should be considered a minimum. The presence of oysters at the time of deposition of the sand also suggests that the climate was warmer than present as oysters are not present in the waters surrounding the islands today, and it is not likely that during mid-Wisconsinan time the climate would have been anomalously warm.

Anse à la Cabane Series

A series of peat and wood samples were taken from a coastal cliff on Anse à la Cabane, Millerand, Iles de la Madeleine, Québec.

GSC-3413. Anse à la Cabane (I)
uncorrected >38 000

The peat, obtained 430 m west of the government wharf (47°12.46'N, 61°58.58'W), at an elevation of approximately 12 m, was collected by D.R. Grant on September 25, 1980; submitted by D.R. Grant. The sample 80.GS.84 (Millerand A) (55.5 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one 5 day count in the 5 L counter with a mixing ratio of 1.00.

Comments (D.R. Grant and R.J. Mott): The sample was drawn from a peat layer, which was the middle (richest) of three 5-10 cm layers in a 1 m thick sand bed overlying Carboniferous shale that had been truncated to form a flat pavement situated about 12 m above tide level. The organic portion was overlain by approximately 2 m of fine (aeolian?) sand, laterally transitional to well rounded pebble gravel, and further by about 2 m of massive, stony, red, silty sand. The sequence evidently represents deposition at a Sangamonian marine shoreline at least 13 m above present tide level. Firstly, the rock platform is considered to be an intertidal abrasion surface because everywhere that it occurs, it is exceedingly planar, gently tilted, terminates abruptly inland against rugged bedrock topography, and is associated with littoral sediment. Secondly, the sediment represents a shoreline deposit.

Physically, the material is typical of that found in marshy coastal environments. Its pollen assemblage is dominated by grasses, indicating widespread areas of beach grass. Birch of both tree and shrub species formed the local vegetation, along with spruce, tamarack, and green alder. Marine hydrozoans and fragments of *Juncus* and *Carex* indicate deposition in mires at a marine shoreline (Fossil Arthropod Reports 82-14, 15, 16; Plant Macrofossil Reports 82-5, 12, 13, 14; J.V. Matthews, pers. comm., 1982). The climate, although distinctly cold and wet compared to the present and not at all like the temperate conditions represented at Portage du Cap and Le Bassin, was nonetheless within the range of conditions hypothesized to have existed during both the last and the present interglaciations. The deposit is therefore referred to Sangamonian time and the sequence is interpreted to mean that a coastal (lagoon margin?) deposit was overrun by a landward-migrating, sandy/gravelly barrier beach as sea level rose (presumably to the 17 m transgressive maximum recorded at Portage du Cap) and was eventually covered by till when Wisconsinan glaciers finally arrived.

GSC-3431. Anse à la Cabane (II)
uncorrected >46 000

The wood, obtained 700 m west of the government wharf (47°13.14'N, 61°59.74'W), at an elevation of approximately 15 m, was collected by D.R. Grant and R.J. Mott on July 17, 1982; submitted by D.R. Grant and R.J. Mott. The sample 82-GS-05 (Millerand B) (44 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water. The age estimate is based on two 1 day and one 4 day counts for 8000 minutes in the 5 L counter with a mixing ratio of 1.00.

Comments (D.R. Grant and R.J. Mott): The wood sample came from a richly organic 20 cm thick bed of detrital peat that was sandwiched between 1-3 m sand and 4-6 m of massive pebbly red till with wedges extending into the sand. The sediments rested on a smoothly truncated platform that had been cut across Carboniferous shale, situated 13 m above sea level. Pollen and macrofossils from three levels in the organic bed were highly variable and dominated successively by nonarboreal taxa of fern, grass, sedge, moss, and heath. The depositional environment was a coastal bog or marsh with nearby forests of spruce that included balsam fir, birch, and possibly pine. The organic bed thus reflects an interglacial-type climate, so the sandy sediment is referred to Sangamonian time. The sedimentary succession is essentially the same as Millerand A and evidently represents the same sequence of events: as the sea rose to 13 m and higher during the Stage 5e transgression, it first cut an intertidal rock platform, then covered it with littoral deposits and coastal organic beds, which were subsequently buried by till (presumably during Wisconsinan glaciation).

General Interpretation:

Iles de la Madeleine Group (D.R. Grant and R.J. Mott)

Sub-till organic and littoral beds show that, during the Sangamonian interglaciation, climate on the islands warmed to an altithermal phase, which a possible minimum age of 106 ka shows correlates with oxygen-isotope substage 5e. Local forest vegetation improved from spruce-fir to pine and thermophilous hardwoods. Meanwhile, sea level was rising; the resulting transgression cut an intertidal abrasion surface in bedrock, then overlaid it with lagoonal and coastal marsh deposits and, eventually, with littoral sand and gravel as barrier beaches migrated upslope to at least 17 m elevation.

Then the transgression climaxed after the climate had begun to cool, just as sea level recovery has lagged the thermal optimum during the present interglaciation. Thus it may be reasonable to suppose that, because the Holocene transgression has been a like amount, about 10-20 m, since the Hypsithermal at 5 ka, the Sangamonian sea-level maximum probably was similarly delayed about 5.0 ka after the temperature maximum. Overlying Shield erratics, patchy tills, and deformed bedrock and sediment show that a largely cold based, Wisconsinan-age, Laurentide Ice Sheet covered the islands. Surface organics, locally beneath colluvium, record a climatic reversal about 10-11 ka, which decimated the vegetation and caused slopes to destabilize. Holocene relative sea-level rise first cut a fossil cliff about 2-3 ka then slowed to allow progradation of barrier beaches now being eroded during a renewed transgression (Grant et al., in press).

Rivière Paspébiac Series

A series of lake sediment samples from 6 km northeast of New Carlisle, at Rivière Paspébiac, Baie des Chaleurs, Québec (48°38'N, 65°16'0"W), at an elevation of approximately 50 m, were collected by P. Bail and C. Labelle on September 14, 1978, submitted by P.J.H. Richard.

GSC-3184. Rivière Paspébiac (I) 3280 ± 80
$\delta^{13}C$= -26.7‰

The lake sediment, mud sample ROB 065-075 (11.9 g dry weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two 1 day counts in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3310 ± 80.

Comment (P.J.H. Richard): This sample allows the calculation of a sediment accumulation rate of 0.21 mm per year for the last 3300 years, during the *Betula* dominated (55-65%) pollen zone.

GSC-4822. Rivière Paspébiac (II) 3280 ± 80
$\delta^{13}C$= -26.2‰

The lake sediment, mud sample ROB 115-125 (13.7 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5300 ± 80.

Comment (P.J.H. Richard): This sample dates the maximum pollen representation of *Pinus strobus* (30%).

GSC-3425. Rivière Paspébiac (III) 7510 ± 110
$\delta^{13}C$= -24.4‰

The lake sediment, mud sample ROB 170-180 (17.78 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two 1 day counts in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7500 ± 110.

Comment (P.J.H. Richard): This sample dates the immigration of *Pinus* (cf. *strobus*) in the area and the end of the *Alnus crispa* pollen zone.

GSC-2992. Rivière Paspébiac (IV)
uncorrected 9800 ± 80

The lake sediment, mud sample ROB 211-222 (51.0 g wet weight) was treated with hot acid and distilled water; base treatment was omitted. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

Comment (P.J.H. Richard): This sample dates the beginning of organic accumulation in the lake and the onset of the *Alnus crispa* pollen zone.

Rivière Madeleine Series

A series of marine shell samples from the east bank of Rivière Madeleine, Gaspésie, Québec were submitted by J.T. Gray (Gray, 1987).

GSC-4580. Rivière Madeleine (I) 2790 ± 60
$\delta^{13}C$= +6.1‰

The marine shells, sample MAD-7E (*Mesodesma arctatum*; identified by J.T. Gray and A. Aitken), were obtained from a natural river bank exposure on the east bank of Rivière Madeleine, 100 m north of bridge (49°14'25"N, 65°18'25"W), at an elevation of 5.5 m. The sample, collected by J.T. Gray on September 13, 1987, (56.6 g dry weight) was treated with an acid leach to remove the outer 30% of the material. The age estimate is based on two counts for 2340 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 2700 ± 60.

Comment (J.T. Gray): This date of 2790 ± 60 BP is for the highest shell-rich gravel layer situated at the highest point of the sandspit. At 5.5 m above present sea level it may represent the culmination of late Holocene sea level rise and of sandspit building.

A stabilization in spit construction and perhaps even a slight temporary lowering of sea level between 3.2 and 2.8 ka is indicated by the fact that the shell-rich beach gravel layer

overlies a buried soil with well developed Ao, Ae, and Bf horizons. Charcoal from the Ao horizon has previously yielded a date of 2870 ± 90 BP (Beta-13856) (Gray, 1987). Thus renewed sea level rise clearly overwhelmed the backshore on the sand spit near its summit. Sometime shortly after 2.7 ka sea level must have begun to fall from its high point of 5.5 m. Small terraces on the sandspit indicate several phases of stability prior to attainment of present sea level.

GSC-4598. Rivière Madeleine (II) 3300 ± 60
$\delta^{13}C$= +2.7‰

The marine shells (whole valves), sample MAD 2-3 (*Mesodesma arctatum*; identified by J.T. Gray) were obtained from a sanitary pit (MAD 2) dug into stratified gravels and sand of spit on north side of Highway 132, just east of Rivière Madeleine bridge (49°14'25"N, 65°18'25"W), at an elevation of 3.3 m. The sample, collected by J.T. Gray on September 13, 1987, (52.6 g dry weight) was treated with an acid leach to remove the outer 30% of the material. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3260 ± 60.

Comment (J.T. Gray): This date of 3300 ± 60 BP is for thick walled, single valves of *Mesodesma arctatum* accumulated in a layer of beach gravels about 3 m below the highest elevation of the sandspit at an elevation of 3.2 m above mean sea level. It gives a minimum age for the construction of the sandspit on top of the intertidal mud flats represented in pit MAD-1. Below the dated layer of shell-rich gravels another 1.4 m of sands and gravels extend to the base of the pit and represent the earliest phase of sandspit construction between 4.5 ka (as indicated by GSC-4564 for the highest mud flat deposits) and 3.2 ka (as indicated by the present date GSC-4598).

The date obtained from this shell-rich gravel bed corresponds well with a previous uncorrected date of 3170 ± 60 BP (Beta-13855) (Gray, 1987) obtained for a similar shell-rich bed located at 4.8 m above mean sea level, 1.4 m below the highest part of the spit. The difference in absolute elevation of the beds at the two sites - 3.2 m compared with 4.8 m - is related to a slight seaward dip in the gravel layers associated with the processes of spit construction.

GSC-4564. Rivière Madeleine (III) 4570 ± 80
$\delta^{13}C$= +3.4‰

The paired marine bivalve shells, sample MAD 1-S6 (*Mya arenaria*; identified by A. Aitken) were obtained from a pit on east bank of Rivière Madeleine, 20 m south of road bridge (49°4'25"N, 65°18'25"W), at an elevation of 2.4 m. The sample (26.9 g dry weight), collected by J.T. Gray on September 12, 1987, was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2130 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4510 ± 80.

Comment (J.T. Gray): The date of 4570 ± 80 BP refers to in situ *Mya arenaria* found in silty sands near the top of a 2.7 m intertidal mud flat sequence. Since the clams do not burrow deeply into the mud flats (rarely more than 15 cm) it is logical to conclude that the mud flats have been built up progressively over the time interval of 4.82 to 4.57 ka. Other factors that indicate a shallow water environment are the presence of a layer of angular and rounded shale clasts and the presence of buried logs in the sediments. A date from Beta Analytic of 4410 ± 80 BP (Beta-13854) (Gray et al., 1987) has been obtained on a log taken from a nearby exposure in the mud flat sandy silts. A date of 4870 ± 80 BP (Beta-13853) (Gray et al., 1987) on *Mya arenaria* was also obtained on shells taken from in situ some 50 cm lower in the sequence. This evidence corroborates the dates from pit MAD 1, which indicate intertidal mud flat accretion associated with a 2-3 m rise in sea level during the interval between 5.0 and 4.5 ka.

GSC-4551. Rivière Madeleine (IV) 4820 ± 60
$\delta^{13}C$= +0.8‰

The marine shells (paired valves), sample MAD 1-S1(a) (*Mya arenaria*; identified by J.T. Gray and A. Aitken), were obtained 20 m south of road bridge, at an elevation of 0.1 m (49°14'25"N, 65°15'25"W). The sample (46.6 g dry weight), collected by J.T. Gray on September 12, 1987, was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2290 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4800 ± 60.

Comment (J.T. Gray): This date is part of a series of four recent GSC dates (GSC-4551, -4564, -4580, -4598) and four Beta Analytic dates (Beta-13853, -13854, -13855, -13856) (Gray et al., 1987) obtained from exposures and pits dug in a prominent coastal spit at Rivière Madeleine, Gaspésie. This spit is believed to have been progressively built up during a temporary Late Holocene rise of sea level, which is believed to have exceeded 5.5 m. The date sequence obtained confirms this conclusion. Because there is little difference between the quoted dates corrected and uncorrected for isotopic fractionation, the corrected dates have been used in discussion of their significance.

This date is a little younger than expected. The organic nature of the enclosing silts and clays indicates that the clam beds were intertidal to subtidal. A sea level slightly higher than present is indicated at 4820 ± 60 BP. Immediately prior to this date, sea level may have been lower but no stratigraphic record is available because the sediments lie directly on top of an abrasion platform which is probably pre-Late Wisconsinan in age. The date does provide an excellent departure point for subsequent sea level rise.

Ile aux Coudres Series

A series of peat and wood samples from Ile aux Coudres, Pointe de la Prairie, Québec was submitted by M. Allard.

GSC-4252. Ile aux Coudres (I)

$\delta^{13}C$= -28.4‰

uncorrected >39 000

The compact peat (tourbe compactée), sample IAC/84-06-05/1B was collected by D. Brodeur and M. Allard on June 5, 1984, at an elevation of approximately 34 m, (47°24.33'N, 70°25.17'W). The sample (28.2 g dry weight) had no treatment. The age estimate is based on one count for 5580 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4500. Ile aux Coudres (II)

$\delta^{13}C$= -27.0‰

uncorrected >39 000

The wood (bois aplati), sample IAC/84-06-05/2A was collected by D. Brodeur and M. Allard on June 5, 1984, at an elevation of approximately 19.6 m (47°24'39"N, 70°24'48"W). The sample (21.1 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 7200 minutes (one 5 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 39 000.

GSC-4501. Ile aux Coudres (III)

$\delta^{13}C$= -27.4‰

uncorrected >41 000

The wood (bois et matière organique toue), sample IAC/83-10-24/A2 was collected by D. Brodeur on October 24, 1983, at an elevation of approximately 19.9 m (47°24'39"N, 70°24'48"W). The sample (9.8 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 5760 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (M. Allard): This series of dates was made on compressed wood and peat from an organic stratigraphical unit below the Late Wisconsinan till. Radiocarbon ages ranging from 26 400 ± 960 BP (UL-10) to 34 430 ± 1770 BP (UL-11) have previously been published (Brodeur and Allard, 1985). Another result, still unpublished, was obtained on a remaining fraction of the UL-11 sample, labelled UL-11-2. It provided a nonfinite age (below background count). The organic unit of Ile aux Coudres belongs to the St. Pierre sediments found in many other sections in the St. Lawrence Valley, and it probably dates back to 70.0 ka or older.

GSC-4330. Cap Lévrard

$\delta^{13}C$= -22.6‰

uncorrected >35 000

The wood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No.86-59)) was enclosed in organic lacustrine silt. Sample 86-LFA 9066-3 was collected by M. Lamothe on October 14, 1986 from Cap Lévrard, 5 km northeast of St-Pierre-Les-Becquets, Québec (46°32'N, 72°10'W), at an elevation of 30 m; submitted by M. Lamothe.

The sample (5.3 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 4170 minutes (three 1 day) in the 2 L counter with a mixing ratio of 1.00.

Deception River Series

A series of marine shell and wood samples were collected in the Deception River valley.

GSC-4341. Deception River (I) 310 ± 50

$\delta^{13}C$= -24.4‰

The wood (driftwood) sample JG 7 (8.5 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-64)), from Cap de Nouvelle France, 50 km northeast of Deception Bay airstrip, Ungava, Québec (62°21'N, 73°50'W), at an elevation of 65 m, was collected by J.T. Gray and B. Lauriol on July 27, 1986; submitted by J.T. Gray. The sample had no treatment. The age estimate is based on two counts for 2070 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 300 ± 50.

Comment (J.T. Gray): This date turned out to be surprisingly young - in fact almost modern. Unless erroneous, the only reasonable explanation is that it represents a fragment of driftwood carried 10 km inland by Inuit hunters for firewood. The origin of the wood - *Picea* sp. - is a mystery in the region 200 km north of the most northerly isolated stands of stunted spruce.

GSC-4540. Deception River (II) 1760 ± 80

$\delta^{13}C$= -27.3‰

The peat sample RD 3-3J, from north side of lower Deception River, 15 km east of Deception Bay airstrip, 5 km north of Asbestos Hill Highway at "Mile 26", Québec (62°7'N, 74°16'W), at an elevation of 106 m, were collected by J.T. Gray and J. Richard on July 30, 1985; submitted by J.T. Gray. The sample (9.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 1800 ± 80.

Comment (J.T. Gray): This date for the uppermost of the 3 peat layers when combined with a Beta Analytic date of 4010 ± 80 BP (Beta-19017) for the basal unit of peat indicates that an accumulation of 5 m of organic peats and aeolian sands took place over a more than 2 ka interval in the Late Holocene. The organic peats are being studied for their macrofossil content. They were probably accumulated in a river channel subsequent to emergence of the glaciomarine delta 7.0 ka. During emergence of the site the delta was dissected by Rivière Deception and slope gullying exposed

sands, which were periodically blown into the channel depression, punctuating three episodes of thick peat formation. Eventually, after 1760 ± 80 BP, the thick peat and sand deposits at the site were dissected by headward migration of a deep gully, leading to exposure of the section.

GSC-4529. Deception River (III) 3850 ± 60
$\delta^{13}C$= +2.7‰

The marine shells, sample RD 10-5C (30.3 g dry weight; *Mya truncata ovata*; identified by J.T. Gray and J. Richard), from 1 km east of Deception Bay airstrip close to "Mile 33" of Asbestos Hill Highway in northernmost Ungava, Québec (62°6'N, 74°30'W), at an elevation of 3 m, were collected by J.T. Gray on August 5, 1985; submitted by J.T. Gray. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 3800 ± 60.

Comment (J.T. Gray): This date is for deposits found within the lowest of a sequence of estuarine terraces at the head of Deception Bay. It gives an accurate age for the transition from fine sands of the lower foreshore to coarse gravelly beach deposits at an altitude of 2 m (a.h.w.m.) during the late Holocene emergence of the region. It can be bracketed between Beta Analytic dates of 4110 ± 110 BP (Beta-11126) for *Mya truncata ovata* found at an elevation of 6 m and 3710 ± 100 BP (Beta-19855) for *Mytilus edulis* from intertidal beach deposits situated at an elevation of 1.7 m. Allowing an intertidal range of approximately 5 m postglacial emergence of less than 7 m is postulated for the last 4.0 ka.

GSC-4388. Deception River (IV) 5210 ± 90
$\delta^{13}C$= +1.5‰

The marine shells, sample RD 16A (24.6 g dry weight; *Mya*, *Macoma calcarea*, and *Hiatella arctica*; identified by J.T. Gray), from the Deception River valley 7 km northeast of Deception Bay airstrip, Ungava, Québec (62°7'N, 74°23'W), at an elevation of 40 m, were collected by J.T. Gray and J. Richard on August 15, 1986; submitted by J.T. Gray. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2090 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.05.

The uncorrected age is 5190 ± 90.

Comment (J.T. Gray): This date in a relatively shallow water regressive sequence of sediments fits very well with the younger dates at lower altitudes in the Deception River valley and with slightly older dates at higher elevations. It is a valuable data point for the establishment of the postglacial emergence curve for the Deception Bay area of northern Ungava.

GSC-4319. Deception River (V) 6800 ± 80
$\delta^{13}C$= +0.7‰

The marine shells, sample RD3-12 (23.8 g dry weight; *Mytilus edulis*; identified by J. Richard), from 15 km east of Deception Bay, lower Deception River valley, Ungava, Québec (62°8'N, 74°16'W), at an elevation of 60 m, were collected by J.T. Gray and J. Richard on August 15, 1986; submitted by J.T. Gray. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4210 minutes (one 2 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6790 ± 80.

Comment (J.T. Gray): The abundance of complete bivalve shells of the shallow water species *Mytilus edulis* made it possible to infer a relative sea level of about 65 m associated with a prominent local strandline. As well as forming an important control point for the postglacial emergence curve in the Deception Bay region, this date also gives a date for the withdrawal of the sea from an embayment into which a large glaciomarine subaqueous fan and delta complex were deposited during the previous 2.0 ka period. Subsequent to this date, rapid postglacial emergence was accompanied by dissection of the fan delta complex by Deception River and tributary gullies.

GSC-4358. Deception River (VI) 6820 ± 100
$\delta^{13}C$= +2.9‰

The marine shells, sample RD2 (26.8 g dry weight; *Mya truncata typica*; identified by J. Gray), from the Deception River valley, 12 km east of Deception River airstrip, Ungava, northern Québec (62°7'N, 74°16'W), at an elevation of 54 m, were collected by J.T. Gray and J. Richard on August 14, 1986; submitted by J.T. Gray. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2390 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6770 ± 100.

Comment (J.T. Gray): This date for a very rich shell site is associated with very favourable conditions for a large variety of shell species in an embayment in the Deception River valley. The elevation and age are quite comparable to these associated with sample RD3-12 (GSC-4319) and confirm the validity of the latter as a good control point for the postglacial emergence curve for the Deception River valley.

GSC-3947. Deception River (VII) 7130 ± 100
$\delta^{13}C$= +0.9‰

The marine shells, sample RR8 (12.1 g dry weight; *Mya truncata*; identified by J-S. Vincent) from mouth of Rivière Renard-Noir, on terrace on left bank, near Deception Bay, Québec (62°7'N, 74°38.5'W), at an elevation of 83 m, were collected by J.T. Gray and B. Lauriol on August 7, 1984; submitted by J-S. Vincent. The sample was treated with an

acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.87.

The uncorrected age is 7120 ± 100.

Comment (J.T. Gray): This date is part of a sequence of seven GSC dates recently provided for the Deception River valley and Cap de Nouvelle France region of northern Ungava (GSC-3947, -4319, -4335, -4341, -4358, -4380, -4529, -4540). These dates complement previous dates obtained by Matthews (1967) and more recently by Gray et al. (1985) and Richard (1989) from Beta Analytic Laboratory. The date of 7120 ± 100 BP for RR8 indicates that ice had retreated from Deception Bay and up the valley of Rivière au Renard Noir prior to 7.1 ka. The shells on the terrace are difficult to relate to a particular sea level. The shells are not in situ, and it is suspected that they represent a mixture of ages during early postglacial emergence of 35 m. This date is not necessarily in conflict with Matthews' old date of 10 450 ± 250 BP (I-488) because independent stratigraphic and chronologic evidence from the middle Deception River valley indicate that deglaciation had proceeded more than 15 km upvalley from Deception Bay as early as 8.5-9.5 ka.

GSC-4335. Deception River (VIII) 8510 ± 230
$\delta^{13}C = +0.5‰$

The marine shells, sample RD3-1B (10.0 g dry weight; *Portlandia arctica* and *Yoldiella fraterna*; identified by A. Aitken), from Deception River valley, 15 km east of Deception Bay airstrip, Ungava, northern Québec (62°7′N, 74°16′W), at an elevation of 58 m, were collected by J.T. Gray and J. Richard on July 25, 1986; submitted by J.T. Gray. The sample was treated with ultrasonic bath to remove adhering sediment; acid leach was omitted. The age estimate is based on two counts for 2170 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.90.

The uncorrected age is 8500 ± 230.

Comment (J.T. Gray): This date is about 1000 years younger than a Beta Analytic date of 9610 ± 140 BP uncorrected for isotopic fractionation (Beta-13861) obtained for a second sample in the same shell bed. The anomaly is difficult to explain for the moment, but it is important because of the stratigraphic position near the base of one of the most important glaciomarine sections in the region.

For the moment it can be concluded that during the interval between 9.6 and 8.5 ka the locality was characterised by a proglacial marine environment and that the earliest glaciomarine phase characterised by 5 m of stratified fossiliferous silts and clays had already terminated. The shell bed was to be resampled in the summer of 1988 to carry out a proper check between results from the GSC and Beta Analytic laboratories. Beta Analytic dated this material at 9535 ± 90 uncorrected (Beta-29085).

Comment (GSC Laboratory): Unfortunately insufficient material was provided to accomplish a valid crosscheck on shell material from this important site, therefore no date is available at this time.

GSC-4171. Kelly Lake
uncorrected 9920 ± 110

The lake sediment, basal gyttja sample AP-1-79 (5.23-5.28) was collected by T.W. Anderson and R. Richardson on November 2, 1979 from Kelly Lake located 4 km west of Bryson, Québec and 30 km north of Renfrew, Ontario (45°40.5′N, 76°39.1′W), at an elevation of 185.3 m; submitted by T.W. Anderson.

The sample (135.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.27.

Comment (T.W. Anderson): Pollen analysis was carried out from 370 to 550 cm in the core. The sample dates the early Holocene rise in *Populus* (Poplar) pollen.

GSC-4326. Calumet Island 10 800 ± 100
$\delta^{13}C = -0.6‰$

The marine shells (*Macoma balthica*; identified by S.H. Richard) were enclosed in silt/clay/fine sand. Sample 85 KAR 1949 was collected by I. Kettles in September of 1986 from Calumet Island, about 6.5 km (4 miles) west-northwest of Campbells Bay, Québec (45°45′20″N, 76°40′45″W), at an elevation of approximately 153 m; submitted by I. Kettles.

The sample (40.4 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 4090 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 100.

GSC-3659. Ottawa River 9460 ± 160
$\delta^{13}C = -26.5‰$

The lake sediment, gyttja was underlain by stratified sandy silt. Sample AP-7-81 (501.5-509 cm) was collected by T.W. Anderson on July 13, 1981 from an unnamed lake on north side (Québec) of Ottawa River, 45 km north of Pembroke, Ontario (46°3′20″N, 77°16′20″W), at an elevation of 315.4 m; submitted by T.W. Anderson.

The sample (173.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2590 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.49.

The uncorrected age is 9490 ± 160.

Comment (T.W. Anderson): This ^{14}C date provides a minimum age for deglaciation of the upper Ottawa valley.

Lac Neume Series

A series of lake sediment, gyttja samples from Lac Neume, Québec (47°35.27′N, 77°6.67′W), at an elevation of 363 m, was collected by J.J. Veillette, P.J.H. Richard, and A. Larouche on March 17, 1981; submitted by P.J.H. Richard.

GSC-4215. Lac Neume (I) 1720 ± 80
$\delta^{13}C$= -30.3‰

The lake sediment, gyttja, sample CGC-27: 095-100 cm (10.4 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 2630 minutes (one 2 day) in the 2 L counter with a mixing ratio of 1.73.

The uncorrected age is 1800 ± 80.

GSC-4208. Lac Neume (II) 3250 ± 100
$\delta^{13}C$= -28.4‰

The lake sediment, gyttja, sample CGC-27: 195-200 cm (9.1 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2390 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.05.

The uncorrected age is 3300 ± 100.

GSC-4185. Lac Neume (II!) 6150 ± 130
$\delta^{13}C$= -31.2‰

The lake sediment, gyttja, sample CGC-27: 325-330 cm (8.4 g dry weight), was treated with hot acid (very slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2560 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.23.

The uncorrected age is 6240 ± 130.

GSC-4172. Lac Neume (IV) 8340 ± 100
$\delta^{13}C$= -30.1‰

The lake sediment, gyttja, sample CGC-27: 420-425 cm (12.7 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.50.

The uncorrected age is 8420 ± 100.

GSC-3246. Lac Neume (V) 8640 ± 160
$\delta^{13}C$= -28.8‰

The lake sediment, gyttja, sample CGC-27: 450-455 cm (70.5 g dry weight), was treated with hot acid (noncalcareous) and distilled water; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 3.41.

The uncorrected age is 8700 ± 160.

Comment (P.J.H. Richard): The 470 cm long core of lake sediments provided a basal date of 8640 ± 160 BP (GSC-3246) from levels 450-455 cm, as a minimum age for the deglaciation in the Laurentians to the northeast of glacial Lake Barlow. The site is beyond the maximum extent of Lake Ojibway. Altogether, the series of dates allow the calculation of an initial 300 years of organic accumulation at the rate of 1 mm per year, followed by rates of 0.43, 0.45, 0.65, and 0.56 mm per year during the successive 2190, 2900, 1530, and 1720 years, respectively, up to the present. Pollen and macrofossil analyses and pollen accumulation rates calculation are interpreted as follows: about 8.7 to 8.3 ka, trees were sparse but present, forming an open boreal woodland dominated by black spruce (*Picea mariana*). Larch (*Larix laricina*), white birch (*Betula papyrifera*), oak (*Quercus*), elm (*Ulmus*), and ash (*Fraxinus*) were however present in the earliest deposits and more abundant than today in the area (Richard and Larouche, 1989). White pine (*Pinus strobus*) has been more abundant than now from 7.0 to 4.0 ka, but the vegetation landscape did not differ much from the present during the last 8.0 ka, apart from an increase in the abundance of spruce and fir during the last 3.0 ka.

GSC-3757. Maganasipi Lake 9250 ± 110
$\delta^{13}C$= -31.3‰

The lake sediment, basal gyttja, sample CGC-42 (615-624 cm), was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 29, 1983 from a circular pond, 200 m in diameter, near the southern end of Maganasipi Lake, Québec (46°31′57″N, 78°21′10″W), at an elevation of 335.0 m; submitted by J.J. Veillette.

The sample (142.2 g wet weight) was treated with hot acid (noncalcareous) and distilled water; base treatment was omitted. The age estimate is based on one count for 4020 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.32.

The uncorrected age is 9350 ± 110.

Comments (J.J. Veillette): The site, in a bedrock basin, is beyond the limit reached by glacial Lake Barlow. A 6.30 m long core was recovered from a water depth of 1.0 m. Solid refusal occurred in till at 6.30 m. The dated portion of the core lies in the transition zone (6.15-6.30 m) from mineral to organic deposit. It is located in the vicinity of GSC-3754 where a complete palynological profile exists (Veillette, 1988; Richard et al., 1989).

GSC-3933. La Grande River
uncorrected 3100 ± 90

The wood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-30)) was enclosed in clay. Sample 1-S-84-709 was collected by J. Paquette on June 7, 1984 from La Grande River, James Bay, 49.3 km from Governer Island, Québec (53°44′N, 78°23′W), at an elevation of 14 m; submitted by Lupien, Rosenberg, Journeaux & Ass.

The sample (12.5 g dry weight) was treated with hot base, hot acid (no reaction), and distilled water. The age estimate is based on one count for 2700 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

Spearman Lake Series

A series of lake sediment, basal gyttja samples, 6 km southeast of Spearman Lake, Québec (46°32′40″N, 78°30′10″W), at an elevation of 368 m, was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 29, 1983.

GSC-4280. Spearman Lake (I) 2300 ± 110
$\delta^{13}C$= -28.3‰

The lake sediment, gyttja sample CGC-41: 95-100 cm, from a circular pond, 200 m in diameter, was submitted by J.J. Veillette. The sample (5.4 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.30.

The uncorrected age is 2360 ± 110.

GSC-4282. Spearman Lake (II) 4350 ± 200
$\delta^{13}C$= -26.9‰

The lake sediment, gyttja sample CGC-41: 180-185 cm, submitted by P.J.H. Richard, (4.7 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2040 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.49.

The uncorrected age is 4380 ± 200.

GSC-4256. Spearman Lake (III) 5950 ± 190
$\delta^{13}C$= -26.4‰

The lake sediment, gyttja sample CGC-41: 280-285 cm, submitted by P.J.H. Richard, (4.8 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2310 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.27.

The uncorrected age is 5970 ± 190.

GSC-4240. Spearman Lake (IV) 7710 ± 160
$\delta^{13}C$= -25.2‰

The lake sediment, gyttja sample CGC-41: 380-385 cm, submitted by P.J.H. Richard, (5.0 g dry weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2040 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.38.

The uncorrected age is 7720 ± 160.

Comment (P.J.H. Richard): The basal date provides a minimum age for ice retreat in the area (Veillette, 1988). The series provides chronological control on the local pollen assemblage zones and allows the calculation of pollen and sediment net accumulation rates (0.42 to 0.63 mm per ^{14}C year). Annual pollen accumulation rates were over 5000 grains/cm^2 during the last 9200 years, oscillating around 10 000 (maximum 13 000) during the entire Holocene. During the proglacial lake Barlow episode, pollen and macrofossil evidence points to the existence of a spruce dominated woodland (*Picea mariana, Larix laricina, Betula papyrifera, Pinus banksiana, Populus*), with dwarf willows and herbs. The pollen accumulation rate curves for *Quercus, Ostrya, Ulmus,* and *Fraxinus* demonstrate that these deciduous trees were present in situ during the Barlow episode, perhaps in protected groves (Richard and Larouche, 1989).

GSC-3754. Spearman Lake (V) 9200 ± 160
$\delta^{13}C$= -30.9‰

The lake sediment, basal gyttja sample CGC-41 (460-470 cm), submitted by P.J.H. Richard, (129.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water; base treatment was omitted. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.36.

The uncorrected age is 9290 ± 160.

Comments (J.J. Veillette): The site, in a bedrock basin, is located beyond the extent of glacial Lake Barlow. A 4.70 m long core was recovered from a water depth of 1.50 m. The date supports the interpretation that hypothesises that the ice retreat on the east side of Ottawa River was slower than on the west side of it (Veillette, 1988). A complete palynological profile was established for this site by P.J.H. Richard (cf. GSC-4240 for additional comments and Richard et al., 1989).

GSC-3689. Grindstone Lake 9440 ± 190
$\delta^{13}C$= -21.2‰

The lake sediment, basal gyttja sample CGC-43 (260-268 cm) was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 29, 1983 from an elliptical pond, 150 x 50 m, 1.5 km south of Grindstone Lake, Québec (46°47′12″N, 78°42′40″W), at an elevation of 369.0 m; submitted by J.J. Veillette.

The sample (128.5 g wet weight) was treated with hot acid (noncalcareous) and distilled water; base treatment was omitted. The age estimate is based on two counts for 2120 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.67.

The uncorrected age is 9380 ± 190.

Comments (J.J. Veillette): The site, in a bedrock basin, is above and beyond the limit reached by glacial Lake Barlow. A 4.18 m-long core was recovered from a water depth of 1.0 m. From 2.68 to 4.18 m the core penetrated fine sand and clayey silt (Veillette, 1988; Richard et al., 1989).

Champlain Sea

This suite of samples includes all the unpublished dates of the late S.H. Richard. Marine shells were collected throughout the western Champlain Sea area by S.H. Richard prior to his untimely death in October, 1987. Most GSC age determinations on shells from Champlain Sea deposits west of Montréal are listed in Richard (1990). Dr. C.G. Rodrigues (University of Windsor), a colleague and co-worker of S.H. Richard, has kindly provided comments and insights on these important dates.

Saint-Valerien-de-Milton Series

Marine pelecypod shells, enclosed in sandy mud, were collected by C.G. Rodrigues on June 26, 1987 from about 5.5 km southwest of Saint-Valerien-de-Milton, Québec (45°32'37"N, 72°46'31"W), at an elevation of 49-53 m and submitted by C.G. Rodrigues.

GSC-4508. Saint-Valerien-de-Milton (I)

The marine pelecypod shells, (*Mya arenaria* Linné; identified by C.G. Rodrigues), sample 87-STHY-2MA (87.7 g dry weight), were treated with an acid leach to remove the outer 20% of the sample, then approximately half of the remaining sample was processed for each fraction.

GSC-4508 OF. 10 700 ± 100
$\delta^{13}C$= -2.4‰

The age estimate for the outer fraction is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 100.

GSC-4508 IF. 10 500 ± 100
$\delta^{13}C$= -1.9‰

The age estimate for the inner fraction is based on two counts for 2500 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 500 ± 100.

Comment (C.G. Rodrigues): The articulated valves of *Mya arenaria* are from the upper part of a section of Champlain Sea sediments. Foraminiferal assemblages from the section show that the sediments containing *Mya arenaria* were deposited in low salinity water (24) and are underlain by sediments deposited in the highest salinity water (24-34) of the Champlain Sea. GSC-4508 IF overlaps the radiocarbon ages (11.4-10.6 ka) for the high salinity phase of the Champlain Sea.

GSC-4518. Saint-Valerien-de-Milton (II) 10 900 ± 190
$\delta^{13}C$= -3.9‰

The marine pelecypod shells (*Macoma balthica* Linné; identified by C.G. Rodrigues), sample 87-STHY-2MB (21.6 g dry weight), were treated with an acid leach to remove the outer ten per cent of the sample. The age estimate is based on two counts for 2420 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.27.

The uncorrected age is 11 000 ± 190.

Comment (C.G. Rodrigues): The articulated valves of *Macoma balthica* are from the same horizon as the shells used for GSC-4508. The GSC-4518 date does not overlap with GSC-4508, but overlaps with the radiocarbon ages for the high salinity phase of the Champlain Sea.

GSC-4196. Mercier 10 300 ± 110
$\delta^{13}C$= +1.3‰

Marine pelecypod shells (RAB-84-6; *Mya truncata* Linné; identified by S.H. Richard) from south of Mercier, 5.3 km east-northeast of Ste.-Martine, Chateauguay County, Québec (45°16.67'N, 73°44.42'W), at an elevation of approximately 41 m, were collected by S.H. Richard and C.G. Rodrigues on June 18, 1982; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (27.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 110.

Comment (C.G. Rodrigues): The *Mya truncata* shells are from the upper part of a pebbly sandy mud unit, which is underlain by ice-contact gravel and sand. Invertebrate fossils were not observed in the ice-contact sediments. Foraminiferal assemblages indicate that the pebbly sandy mud was deposited in the highest salinity water (30-34‰) of the Champlain Sea. To my knowledge this is the first site where *Mya truncata* is accompanied by maximum salinity foraminiferal assemblages. The pelecypod species occurs in sediments associated with low salinity water (less than 30‰) at other sites, e.g., Saint-Joseph-du-Lac (cf. GSC-4159), Rivière-Beaudette (Rodrigues and Richard, 1983), and Ste-Justine-de-Newton (Rodrigues, 1988). If the dated *Mya truncata* shells lived in the maximum salinity water, then GSC-4196 is the youngest age determination on invertebrate fossils associated with the maximum salinity water of the Champlain Sea.

Mya truncata is also present in the lower part of a sandy mud unit that is underlain by the pebbly sandy mud unit from which the pelecypod valves used for dating were collected. Foraminiferal and ostracode assemblages indicate low salinity conditions (less than 30‰) during deposition of the sandy mud. *Mya truncata* is an infaunal burrowing pelecypod. Therefore, the pelecypod species may have burrowed into the upper part of the pebbly sandy mud, which is directly below the sandy mud. This would explain the

relatively young age of the *Mya truncata* shells from the pebbly sandy mud, which was deposited in maximum salinity water.

GSC-4196 is identical to the date of 10 300 ± 100 BP (GSC-2261; Lowdon and Blake, 1979) for *Mya truncata* from an elevation of about 74 m, at the Ste-Justine-de-Newton site; it is older than the date of 9880 ± 80 BP (cf. GSC-4159) for the same species from an elevation of about 96 m, at the St-Joseph-du-Lac site.

GSC-4251. La Trappe 10 300 ± 140
$\delta^{13}C = -0.8‰$

Marine pelecypod shells (RAB-75-37; *Macoma balthica* Linné; identified by S.H. Richard) from 1.0 km east of La Trappe and 4.0 km northeast of Oka, Québec (45°29.75′N, 74°0.67′W), at an elevation of about 70 m. The sample was collected by S.H. Richard on August 27, 1975; submitted by S.H. Richard.

The sample (12.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count (4200 minutes) in the 2 L counter with a mixing ratio of l.79.

The uncorrected age is 10 300 ± 140.

Comment (C.G. Rodrigues): The submitter pointed out that the shells of *Macoma balthica*, which were from pebbly sand, should date the end of marine submergence in the western Champlain Sea basin immediately before the freshwater Lampsilis Lake phase. GSC-4251 is older than the date of 9880 ± 80 BP (GSC-4159) for shells of *Mya truncata* from an elevation of about 96 m.

GSC-4159. Saint-Joseph-du-Lac 9880 ± 80
$\delta^{13}C = +1.5‰$

Marine pelecypod shells (RAB-82-19; *Mya truncata* Linné; identified by S.H. Richard and C.G. Rodrigues) from northwest of Saint-Joseph-du-Lac, 5.0 km southeast of Saint-Benoit, Deux-Montagnes County, Québec (45°32.92′N, 74°2.58′W), at an elevation of approximately 96 m, were collected by S.H. Richard and C.G. Rodrigues on July 5, 1982; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (47.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9860 ± 80.

Comment (C.G. Rodrigues): The *Mya truncata* shells, which were articulated, are from a pebbly muddy sand that is underlain by a massive stony diamicton. The foraminiferal and ostracode assemblages accompanying the pelecypod shells indicate that the pebbly muddy sand was deposited in cold (subarctic) low salinity (less than 30‰) water.

Articulated values of the pelecypod *Mya arenaria* Linné are present in bedded sand, which is stratigraphically above the *Mya truncata* shells. The *Mya arenaria* assemblage is related to boreal low salinity conditions. Three radiocarbon dates were reported for the *Mya arenaria* shells, 9950 ± 185 BP (Gif-2107; Gangloff, 1974), 10 330 ± 100 BP (GrN-2035; Elson, 1969), and 10 500 ± 270 BP (QU-50; Hillaire-Marcel, 1974). If the dates for *Mya arenaria* are taken at face value then GrN-2035 and QU-50 are older than Gif-2107. Similarly, GrN-2035 and QU-50 are older than the date (GSC-4159) for *Mya truncata* from a stratigraphically older unit.

GSC-3853. St-Stanislas-de-Kostka 10 500 ± 210
$\delta^{13}C = -0.4‰$

Marine pelecypod shells (RAB-82-21; *Portlandia arctica* Gray; identified by S.H. Richard) from 1.0 km northwest of St-Stanislas-de-Kostka, Beauharnois County, Québec (45°11′0″N, 74°8′20″W), at an elevation of 42 m, were collected by S.H. Richard and C.G. Rodrigues on July 14, 1982; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (10.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 2.24.

The uncorrected age is 10 500 ± 210.

Comment (C.G. Rodrigues): The *Portlandia arctica* shells, which were articulated and retained the periostracum, are from a massive mud, which is overlain by massive sand. The pelecypod *Macoma balthica* is present in the massive mud above the interval containing *Portlandia arctica* and the pelecypod *Lampsilis* sp. is present in the massive sand. The foraminiferal assemblages accompanying *Portlandia arctica* and *Macoma balthica* indicate bottom-water salinity less than 30‰ during deposition of the massive mud and decreasing salinity conditions from the interval containing *Portlandia arctica* to that containing *Macoma balthica*. The massive sand containing *Lampsilis* sp. was deposited in a freshwater environment that followed the Champlain Sea. The date provides a minimum age for the change from maximum salinity (30-34‰) to lower salinity conditions.

GSC-4133. Hudson 10 600 ± 110
$\delta^{13}C = -1.9‰$

Marine pelecypod shells (RAB-75-50; *Macoma balthica* Linné; identified by S.H. Richard) from 4.5 km west of Hudson, Vaudreuil County, Québec (45°27.17′N, 74°12.83′W), at an elevation of approximately 70 m, were collected by S.H. Richard on September 5, 1975; sample submitted by S.H. Richard.

The sample (48.1 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 600 ± 110.

Comment (C.G. Rodrigues): The shells of *Macoma balthica* are from massive sand, which is overlain by sand and gravel. The submitter pointed out that the pelecypod shells were obtained from the lowest beach deposit in the area and concluded that the date for the shells should be about 10.0 ka. GSC-4133 is older than was anticipated.

GSC-4132. Rigaud 11 100 ± 130
$\delta^{13}C$= -0.7‰

Cirriped plates (RAB-84-9; *Balanus hameri* Ascanius; identified by S.H. Richard) from 4.4 km east of Rigaud and 2 km southeast of Dragon, Vaudreuil County, Québec (45°25.08′N, 74°15.17′W), at an elevation of about 28 m, were collected by S.H. Richard on June 21, 1984; sample submitted by S.H. Richard.

The sample (27.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 100 ± 130.

Comment (C.G. Rodrigues): The plates of the barnacle *Balanus hameri* are from pebbly sandy mud, which is underlain by ice-contact sediments. Most of the barnacles were still in growth position with basal plates attached to pebbles. The foraminiferal assemblage accompanying *Balanus hameri* indicates salinity between 30 and 34‰ (maximum salinity) during deposition of the pebbly sandy mud (Rodrigues, 1988). GSC-4132 provides a minimum age for the arrival of maximum salinity water at the site.

GSC-3882. Cazaville

Marine pelecypod shells (RAB-81-17; *Hiatella arctica* Linné; identified by S.H. Richard) from 3.0 km southeast of Cazaville, 13.0 km west of Huntingdon, Huntingdon County, Québec (45°4′0″N, 74°20′50″W), at an elevation of 71-72 m, were collected by S.H. Richard and C.G. Rodrigues on July 22, 1981; sample submitted by S.H. Richard. The sample (80.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample, then approximately half of the remaining sample was processed for each fraction.

GSC-3882 OF. 10 300 ± 90
$\delta^{13}C$= -0.1‰

The age estimate for the outer fraction (OF) is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 90.

GSC-3882 IF. 10 500 ± 90
$\delta^{13}C$= +1.2‰

The age estimate for the inner fraction (IF) is based on one 4 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 400 ± 90.

Comment (C.G. Rodrigues): The submitter pointed out that the shells of *Hiatella arctica* are from the base of a fossiliferous, bouldery till, which is underlain by an unfossiliferous, sandy till. He concluded that the fossiliferous till is related to a late readvance of the Laurentide Ice Sheet into the Ottawa - St. Lawrence lowland (see Fulton and Richard, 1987, p. 28). It is possible, however, that what the collector identified as till is either a marine lag developed from till or diamicton formed by sea ice push. GSC-3882 IF is identical to the date of 10 500 ± 110 BP (GSC-2391; Lowdon and Blake, 1979) for *Hiatella arctica* from a fossiliferous till at the Sainte-Justine-de-Newton site. The date of 10 600 ± 130 BP (GSC-2265; Lowdon and Blake, 1979) for shells of *Hiatella arctica* from a stony diamicton at the Saint-Lazare-de-Vaudreuil site is comparable to GSC-3882 IF.

GSC-4228. Ste-Agnès-de-Dundee 10 100 ± 180
$\delta^{13}C$= -1.5‰

Marine pelecypod shells (RAB-75-26; *Mya arenaria* Linné; identified by S.H. Richard) from 2.0 km southeast of Ste-Agnès-de-Dundee, Québec (45°0.25′N, 74°22.75′W) at an elevation of 57 m. The sample was collected by S.H. Richard on July 30, 1975; submitted by S.H. Richard.

The sample (13.3 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two 1 day counts (2060 minutes) in the 2 L counter with a mixing ratio of 1.58.

The uncorrected age is 10 100 ± 180.

Comment (C.G. Rodrigues): The shells of *Mya arenaria* are from pebbly sand, which was deposited in boreal low salinity water during part of the Champlain Sea episode. GSC-4228 is one of the youngest dates obtained on *Mya arenaria* from deposits west of Montreal (cf. GSC-3845 and -4477).

GSC-4258. Très-St-Rédempteur 11 200 ± 150
$\delta^{13}C$= -0.6‰

Cirriped plates (RAB-75-48A; *Balanus hameri* Ascanius; identified by S.H. Richard), from 3.5 km south of Très-St-Rédempteur, Québec (45°24′0″N, 74°23′0″W) at an elevation of 80 m, were collected by S.H. Richard on September 4, 1975; submitted by S.H. Richard.

The sample (46.9 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count (4050 minutes) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 200 ± 150.

Comment (C.G. Rodrigues): The plates of *Balanus hameri* are from pebbly mud overlying unfossiliferous gravel. *Balanus hameri* colonized the highest salinity water of Champlain Sea (Rodrigues, 1988). GSC-4258 provides a minimum age for arrival of high salinity water at the site.

GSC-4477. Alexandria 10 500 ± 190
$\delta^{13}C$= +0.2‰

Marine pelecypod shells (RAB-86-37; *Mya arenaria* Linné; identified by S.H. Richard) from 4.1 km east of Alexandria, Ontario (45°18′20″N, 74°34′35″W) at an elevation of 83 m were collected by S.H. Richard on November 17, 1986; submitted by S.H. Richard.

The sample (29.2 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2270 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 500 ± 190.

Comment (C.G. Rodrigues): The shells of *Mya arenaria* are from sand at the upper part of a section containing marine fossils. *Mya arenaria* migrated into the central St. Lawrence Lowland during the final stages of the Champlain Sea episode and lived in the shallow parts of the sea where salinity was less than 25‰. GSC-4477 is comparable to the date of 10 500 ± 100 BP (GSC-3475; Blake, 1982) for the same species.

GSC-3845. Glenroy 10 700 ± 100
$\delta^{13}C$= -2.7‰

Marine shells (RAB-82-11; *Mya arenaria* Linné; identified by S.H. Richard and C.G. Rodrigues) from north-northwest of Glenroy, Glengarry County, 7.5 km south of Alexandria, Ontario (45°14′ 30"N, 74°38′ 55"W), at an elevation of 79-80 m, were collected by S.H. Richard and C.G. Rodrigues on June 30, 1982; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (48.7 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 100.

Comment (C.G. Rodrigues): The *Mya arenaria* shells, which are articulated, are from a sandy mud unit that is underlain by a *Hiatella arctica* shell bed. The sandy mud was deposited in boreal low salinity water during the later part of the Champlain Sea episode. The date of 10 500 ± 100 BP (GSC-3475; Blake, 1982) for *Mya arenaria* from an elevation of 76 m, at the Ste-Justine-Station site is comparable to GSC-3845.

Dornie Series

Cirriped plates were collected from marine sediments 5 km west of Alexandria and 2 km west of Dornie, Ontario (49°19′0″N, 74°42′10″W).

GSC-4468. Dornie (I) 10 900 ± 120
$\delta^{13}C$= -0.9‰

Cirriped plates (RAB-86-27; *Balanus hameri* Ascanius, identified by S.H. Richard), at an elevation of 106 m, were collected by S.H. Richard on November 3, 1986; submitted by S.H. Richard.

The sample (34.6 g dry weight) was treated with acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2675 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 900 ± 120.

Comment (C.G. Rodrigues): The plates are from pebbly mud at the base of a 5 m thick fossiliferous sequence which is underlain by an unfossiliferous pebbly cobbly diamicton. The foraminiferal assemblage accompanying the cirriped plates indicate salinity between 30 and 34‰ (maximum salinity) during deposition of the pebbly mud. GSC-4468 provides a minimum age for the arrival of maximum salinity water at the site.

GSC-4235. Dornie (II) 10 500 ± 170
$\delta^{13}C$= -1.6‰

Cirriped plates (RAB-76-110A, *Balanus crenatus* Bruguière; identified by S.H. Richard), at an elevation of 97 m, were collected by S.H. Richard on September 17, 1976; submitted by S.H. Richard.

The sample (10.7 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.05.

The uncorrected age is 10 500 ± 170.

Comment (C.G. Rodrigues): The plates of *Balanus crenatus* are from bouldery, cobbly gravel stratigraphically above the plates of *Balanus hameri* used for GSC-4468. *Balanus crenatus* is associated with sediments deposited in low salinity water (less than 30‰) of Champlain Sea. GSC-4235 provides a minimum age for the change from maximum to low salinity conditions at the site. GSC-4235 is also older than the date of 9910 ± 150 BP (BGS-258) reported by Sharpe (1979) for shells of *Hiatella arctica* from a comparable stratigraphic position at the site.

GSC-4315. Casselman 10 200 ± 120
$\delta^{13}C$= +2.0‰

Marine pelecypod shells (RAB-74-38; *Hiatella arctica* Linné; identified by S.H. Richard) from 6 km south of Casselman, Ontario (45°15′30″N, 75°5′10″W) at an elevation of 73 m were collected by S.H. Richard on September 20, 1974; submitted by S.H. Richard.

The sample (28.2 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two 2 day counts (7030 minutes) in the 206 counter with a mixing ratio of 1.00.

The uncorrected age is 10 100 ± 120.

Comment (C.G. Rodrigues): The shells of *Hiatella arctica* are from sand deposited in low salinity water during the final stages of the Champlain Sea episode west of Montreal. GSC-4315 is comparable to GSC-3907 (OF and IF).

GSC-4043. Crysler 10 900 ± 90
$\delta^{13}C$= -0.9‰

Cirriped plates (RAB-85-5(A); *Balanus hameri* Ascanius; identified by S.H. Richard) from 4.8 km east of Crysler, Stormont County, Ontario (45°13.42'N, 75°5.50'W), at an elevation of 69 m, were collected by C.G. Rodrigues and S.H. Richard on June 18, 1984; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (36.7 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 900 ± 90.

Comment (C.G. Rodrigues): The plates of the barnacle *Balanus hameri* are from pebbly mud, which rests unconformably on ice-contact gravel and sand. Most of the barnacles were still in growth position with basal plates attached to pebbles. The foraminiferal assemblage accompanying *Balanus hameri* indicates salinity between 30 and 34‰ (maximum salinity) during deposition of the pebbly mud. GSC-4043 is the second age determination on invertebrate marine fossils from the site. The first age determination GSC-2614 (10 900 ± 100 BP; Lowdon and Blake, 1980), on shells of the pelecypods *Macoma balthica* Linné and *M. calcarea* (Gmelin) is identical to GSC-4043. The shells of *Macoma* spp. are stratigraphically above the barnacle plates. The *Macoma balthica* - *Macoma calcarea* assemblage is related to low salinity conditions, which followed maximum salinity conditions at the site. Therefore, GSC-2614 should be younger than GSC-4043. Alternatively, the shells of *Macoma* spp. may be reworked from an older marine unit and therefore older than the sand in which they were found.

Sparrowhawk Point Series

Marine pelecypod shells were collected from a sequence consisting of glacial and marine sediments at a site 4 km south of Iroquois, Ontario and 11 km west-southwest of Waddington, New York (44°48'30"N, 75°19'20"W).

GSC-3767. Sparrowhawk (Point I) 11 900 ± 100
$\delta^{13}C$= +0.2‰

Marine shells (RAB-83-22; *Portlandia arctica* Gray; identified by C.G. Rodrigues) from an elevation of 76 m, were collected by S.H. Richard and C.G. Rodrigues on November 22, 1983; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (37.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 900 ± 100.

GSC-4044. Sparrowhawk (Point II) 11 900 ± 140
$\delta^{13}C$= +0.3‰

Marine shells (RAB-85-15; *Portlandia arctica* Gray; identified by S.H. Richard) from an elevation of 75 m, were collected by C.G. Rodrigues and S.H. Richard on August 9, 1984; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (13.8 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.75.

The uncorrected age is 11 900 ± 140.

GSC-3788. Sparrowhawk (Point III) 11 300 ± 100
$\delta^{13}C$= -2.7‰

Marine shells (RAB-83-23; *Macoma balthica* Linné; identified by C.G. Rodrigues) from an elevation of 80 m, were collected by S.H. Richard and C.G. Rodrigues on October 23, 1983; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (33.9 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 400 ± 100.

Comment (C.G. Rodrigues): A 10 m section consisting of massive stony till overlain by rhythmically laminated silt and clay ("varves"), which, in turn, is overlain by massive mud and sand, is exposed in the shore cliffs on the south side of St. Lawrence River. The contact between the varve-like sediments and the massive mud is gradational. Invertebrate fossils were not observed in the till. Foraminiferal and ostracode assemblages from the fossiliferous portion of the sequence indicate a succession from freshwater (varve-like sediments) to low salinity (massive mud and sand) conditions (Rodrigues, 1988). At one spot along the shore the varve-like sediments are truncated and underlain by massive mud. Low salinity foraminiferal and ostracode assemblages are present in the massive mud underlying the varve-like sediments (freshwater).

The *Portlandia arctica* shells used for GSC-3767 (Sparrowhawk Point I) are from the lower part of the massive marine mud, which overlies the varve-like sediments (freshwater). GSC-3767 should provide an approximate age for the end of glaciolacustrine conditions and the beginning of marine conditions.

The *Portlandia arctica* shells used for GSC-4044 (Sparrowhawk Point II) are from the massive marine mud underlying the varve-like sediments. Rodrigues (1987) suggested that the presence of massive mud below varve-like

sediments is probably related to postdepositional slumping. The equivalent age ranges of GSC-4044 and -3767 are consistent with the slumping hypothesis.

The *Macoma balthica* shells used for GSC-3788 (Sparrowhawk Point III) are from sand in the upper part of the section. GSC-3788 indicates that low salinity conditions (less than 30‰) persisted at the site until 11.4 to 11.2 ka.

Anderson (1987) and Rodrigues (1988) concluded that the Champlain Sea episode began between 11.5 and 11.0 ka west of 74°W longitude. If their estimate for the beginning of the marine transgression in the western part of the central St. Lawrence Lowland is correct, then, GSC-3767, -4044, and -3788 are too old.

Bearbrook Series

Marine pelecypod shells and cirriped plates were collected from an active sand and gravel pit 0.2 km north of Bearbrook, Russell County, Ontario (45°23'30"N, 75°20'30"W); samples submitted by S.H. Richard and C.G. Rodrigues.

GSC-3983. Bearbrook (I)

Cirriped plates (RAB-84-11; *Balanus hameri* Ascanius; identified by C.G. Rodrigues) at an elevation of 62 m, were collected by C.G. Rodrigues and S.H. Richard on June 19, 1984. The sample (51.0 g dry weight) had no leach prior to processing. Approximately 60% of the sample was reacted for the outer fraction; the remaining sample (approximately 40%) was processed as the inner fraction.

GSC-3983 OF. 10 700 ± 130
$\delta^{13}C$= -0.9‰

The age estimate for the outer fraction (OF) is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 130.

GSC-3983 IF. 10 800 ± 130
$\delta^{13}C$= -0.2‰

The age estimate for the inner fraction (IF) is based on one 3 day count in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 130.

GSC-3907. Bearbrook (II)

Marine pelecypod shells (sample RAB-84-12; *Hiatella arctica* Linné; identified by C.G. Rodrigues), at an elevation of approximately 68 m, were collected by S.H. Richard and C.G. Rodrigues on August 15, 1984. The sample (56.5 g dry weight) had no leach prior to processing. Approximately half of the sample was processed for each fraction.

GSC-3907 OF. 10 200 ± 110
$\delta^{13}C$= -0.8‰

The age estimate for the outer fraction (OF) is based on one 3 day count in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 110.

GSC-3907 IF. 10 200 ± 90
$\delta^{13}C$= +0.3‰

The age estimate for the inner fraction (IF) is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 200 ± 90.

Comment (C.G. Rodrigues): The sequence exposed at the site consisted of (1) stratified sand, (2) rhythmically laminated silt and clay-"varves", (3) laminated pebbly mud with gravel lens, (4) pebbly sand, (5) stratified sand and mud, (6) pebbly sand with mud lenses, (7) shell bed with pebbly sand matrix, and (8) gravel and sand. Invertebrate fossils were not observed in units 1 and 8. Foraminiferal and ostracode assemblages from the fossiliferous portion of the sequence indicate a succession from freshwater (Unit 2) to low salinity (Unit 3) to maximum salinity (Unit 4) to decreasing salinity (units 5 to 7) conditions.

The plates of the barnacle *Balanus hameri* are from the pebbly sand (Unit 4). Most of the barnacles were still in growth position with basal plates attached to pebbles. GSC-3983 (Bearbrook I) provides a minimum age for the arrival of maximum salinity water (30-34‰) at the site.

The valves of the pelecypod *Hiatella arctica* are from the shell bed with pebbly sand matrix (Unit 7) which is overlain by unfossiliferous gravel and sand (Unit 8). GSC-3907 (Bearbrook II) provides an approximate age for the end of marine sedimentation at the site.

GSC-4359. Buckingham 11 500 ± 190
$\delta^{13}C$= -0.8‰

Marine pelecypod shells (RAB-78-16; *Macoma balthica* Linné; identified by S.H. Richard) from northeast of Buckingham, Québec (45°36'25"N, 75°23'08"128MÆW), at an elevation of 127 m were collected by S.H. Richard on August 23, 1978; submitted by S.H. Richard.

The sample (16.9 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 3770 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.33.

The uncorrected age is 11 600 ± 190.

Comment (C.G. Rodrigues): The submitter pointed out that the shells of *Macoma balthica* are from the upper part of a deltaic sand deposited on the floor of Champlain Sea during phase of the marine submergence in the Buckingham area.

GSC-3835. Val des Monts
uncorrected 11 200 ± 100

Marine pelecypod shells (RAB-82-51; *Macoma balthica* Linné; identified by S.H. Richard) from 1.6 km north of Val des Monts, Hull County, Québec (45°36'50"N, 75°36'35"W), at an elevation of 178-180 m, were enclosed in glaciomarine(?) sand. The sample was collected by S.H. Richard on October 8, 1982; sample submitted by S.H. Richard.

The sample (45.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

Comment (D.R. Sharpe): This sample is from a sand unit that overlies a clay containing marine fossils. This clay unit is transitional from an underlying sandy unit and together they form a package of sediments that represents subaqueous fan deposition at a tidewater glacier margin. The sand unit containing the sample is either a glaciomarine sand unit, representing continued subaqueous fan deposition, or it represents a littoral reworking of fan sediments. A source of sand to produce a thick littoral unit over clay is a problem, but there is also a sharp break between the clay and the overlying sand. The underlying clay unit is fossiliferous and contains *Portlandia arctica*, *Mytilus edulis*, *Hiatella arctica*, *Macoma balthica*, and *Balanus* sp. The lowest unit, a sandy sequence, is apparently unfossiliferous but trace fossils (burrows) have been observed at the transition from sandy to clayey sediments.

The sample is a monospecific assemblage of *Macoma balthica*, which occur in vertical or growth position as articulated valves. The shells are thus in situ and appear to date the upper sand deposits. The deposit is found at or close to marine limit of approximately 200 m a.s.l. and hence little time for emergence. The date thus provides a minimum age for deglaciation of this site. If other dates in the northern portion of the Champlain Sea basin are correct (e.g., GSC-1646, 12 200 ± 160 BP, cf. Fulton and Richard, 1987, Lowdon and Blake, 1973), then ice remained in contact with the sea for approximately 1.0 ka before leaving the basin. Dates on the lower fossils would allow one to evaluate whether this date represents initial deglaciation and that the 12.0 ka dates are somehow in error.

GSC-4350. Manotick 10 600 ± 100
$\delta^{13}C$= -1.0‰

Marine pelecypod shells (RAB-70-18; *Macoma balthica* Linné; identified by S.H. Richard) from 6.4 km south of Manotick, Ontario (45°10'40"N, 75°39'10"W), at an elevation of about 98 m, were collected by S.H. Richard on July 14, 1970; submitted by S.H. Richard.

The sample (215.1 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 600 ± 100.

Comment (C.G. Rodrigues): The shells of *Macoma balthica* are from marine clay in the upper part of a section containing marine fossils. GSC-4350 provides a minimum age for the change from high to low salinity conditions at the site.

GSC-4070. Watterson Corners

Cirriped plates (RAB-84-4; *Balanus hameri* Ascanius; identified by S.H. Richard) from 0.4 km south of Watterson Corners and 3.0 km south of Manotick, Carleton County, Ontario (45°12.00'N, 75°41.75'W), at an elevation of approximately 93 m, were collected by S.H. Richard and C.G. Rodrigues on May 25, 1984; sample submitted by S.H. Richard and C.G. Rodrigues. The sample (79.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample, then approximately half of the sample was processed for each fraction.

GSC-4070 OF. 11 200 ± 110
$\delta^{13}C$= -1.1‰

The age estimate for the outer fraction (OF) is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 200 ± 110.

GSC-4070 IF. 11 300 ± 110
$\delta^{13}C$= -0.8‰

The age estimate for the inner fraction (IF) is based on one 4 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 300 ± 110.

Comment (C.G. Rodrigues): The sequence exposed at the site consisted of (1) ice-contact gravel and sand, (2) pebbly, cobbly sand, (3) pebbly mud and sandy mud, and (4) pebbly sand. Invertebrate fossils were not observed in Unit 1. Foraminiferal and ostracode assemblages from the fossiliferous portion of the sequence indicate a succession from maximum salinity (Unit 2) to decreasing salinity (Units 3 and 4) conditions.

The plates of the barnacle *Balanus hameri* are from the base of the pebbly, cobbly sand (Unit 2). Most of the barnacles were still in growth position with basal plates attached to pebbles and cobbles. GSC-4070 provides an approximate age for the arrival of maximum salinity water (30-34‰) at the site.

GSC-3834. St-Pierre-de-Wakefield 11 700 ± 150
$\delta^{13}C$= -1.1‰

Marine pelecypod shells (RAB-81-36; *Portlandia arctica* Gray; identified by S.H. Richard) from 2.4 km east of St-Pierre-de-Wakefield, Hull County, Québec (45°39'25"N, 75°42'30"W), at an elevation of 160-162 m, were collected by S.H. Richard on October 25, 1981; sample submitted by S.H. Richard.

The sample (13.2 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 4 day count in the 2 L counter with a mixing ratio of 1.72.

The uncorrected age is 11 800 ± 150.

Comment (C.G. Rodrigues): The shells of *Portlandia arctica* are from massive mud, which is overlain by pebbly sand. Invertebrate fossils were not observed in the pebbly sand. Foraminiferal and ostracode assemblages accompanying the pelecypod shells indicate that the massive mud was deposited in cold (subarctic) low salinity (less than 30‰) water (Rodrigues, 1988). GSC-3834 provides a minimum age for deglaciation and marine submergence of the area.

GSC-3865. Val-Paquin 11 500 ± 130
$\delta^{13}C = -1.7‰$

Marine pelecypod shells (RAB-81-27; *Macoma balthica* Linné; identified by S.H. Richard) from 0.8 km north of Val-Paquin, Gatineau County, Québec (45°44'55"N, 75°43'5"W), at an elevation of 195-198 m, were collected by S.H. Richard on September 30, 1981; sample submitted by S.H. Richard.

The sample (26.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 500 ± 130.

Comment (C.G. Rodrigues): The shells of *Macoma balthica* are from muddy sand at the maximum extent of the Champlain Sea. The foraminiferal and ostracode assemblages accompanying the pelecypod shells indicate that the muddy sand was deposited in cold (subarctic) low salinity (less than 30‰) water (Rodrigues, 1988). GSC-3865 provides a minimum age for deglaciation and marine submergence of the area.

GSC-3997. Lucerne 11 200 ± 130
$\delta^{13}C = +0.7‰$

Marine pelecypod shells (RAB-81-26; *Macoma balthica* Linné; identified by S.H. Richard) from 0.7 km north of Lucerne, Gatineau County, Québec (45°45'30"N, 75°43'50"W), at an elevation of 175 m, were enclosed in marine clay. The sample was collected by S.H. Richard on September 30, 1981; sample submitted by S.H. Richard.

The sample (20.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.31.

The uncorrected age is 11 200 ± 130.

Comment (S.H. Richard): Marine shells submitted were collected from a freshly opened cut in roadside drainage ditch 1 m below ground level in grey, massive, unctuous, marine clay unit. No other unit is exposed here: shells of the marine species *Hiatella arctica* are also present here in the Champlain Sea clay at the same level, although specimens are all very small or dwarfed?

Comment (C.G. Rodrigues): The foraminiferal assemblage accompanying the pelecypod shells indicates that salinity was less than 30‰ during deposition of the massive mud (Rodrigues, 1988).

GSC-4052. Twin Elm 10 800 ± 110
$\delta^{13}C = +0.7‰$

Cirriped plates (sample RAB-82-9; *Balanus hameri* Ascanius; identified by S.H. Richard) from 3 km east-northeast of Twin Elm, Carleton County, Ontario (45°14.00'N, 75°46.42'W), at an elevation of approximately 97 m, were collected by S.H. Richard and C.G. Rodrigues on June 8, 1982; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (47.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 110.

Comment (C.G. Rodrigues): The sequence exposed at the site consisted of (1) massive, stony diamicton, (2) rhythmically laminated silt and clay-"varves", (3) pebbly, sandy mud, (4) pebbly sand (5) shell bed with pebbly sand matrix, (6) stratified sand, and (7) gravel and sand. Invertebrate fossils were not observed in units 1 and 7. Foraminiferal and ostracode assemblages from the fossiliferous portion of the sequence indicate a succession from freshwater (Unit 2) to low salinity (Unit 3) to maximum salinity (Unit 4) to decreasing salinity (Units 5 and 6) conditions.

The plates of the barnacle *Balanus hameri* are from the pebbly sand (Unit 4). Most of the barnacles were still in growth position with basal plates attached to pebbles. GSC-4052 provides a minimum age for the arrival of maximum salinity water (30-34‰) at the site.

GSC-3844. Cantley
uncorrected 11 800 ± 170

Marine pelecypod shells (sample RAB-82-35; *Macoma balthica* Linné; identified by S.H. Richard) from 1.0 km northeast of Cantley, Gatineau County, Québec (45°34'5"N, 75°46'25"W), at an elevation of approximately 195 m, were collected by S.H. Richard on October 1, 1982; sample submitted by S.H. Richard.

The sample (11.7 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.94.

Comment (C.G. Rodrigues): The shells of *Macoma balthica* are from a massive mud at the maximum extent of Champlain Sea. The date was not corrected for isotopic

fractionation, however, it is unlikely that the correction would affect the age determination by more than 100 radiocarbon years. GSC-3844 is the second age determination on *Macoma balthica* from the gravel and sand pit. The first age determination, 12 200 ± 160 BP uncorrected (GSC-1646; Lowdon and Blake, 1973), on shells at an elevation of approximately 194 m, is older than GSC-3844.

GSC-4213. Hall Cemetery 10 700 ± 110
$\delta^{13}C = +0.5‰$

Marine pelecypod shells (84-WAKE-1-7A; *Hiatella arctica* Linné; identified by C.G. Rodrigues) from Hall Cemetery, 1 km south of Wakefield on the north side of Route 105, Wakefield, Québec (45°37′20″N, 75°55′45″W), at an elevation of 150 m were collected by C.G. Rodrigues on July 14, 1984; submitted by C.G. Rodrigues.

The sample (40.4 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 110.

Comment (C.G. Rodrigues): This is the second date on shells of *Hiatella arctica* from mud at the Hall Cemetery site. The first date, 10 800 ± 110 BP (GSC-4088; Rodrigues, 1988), is almost identical to GSC-4213. Both GSC-4088 and -4213 are slightly younger than the date of 11 100 ± 120 BP (GSC-4056; Fulton and Rodrigues, 1987) for shells of *Macoma balthica* about 2 m above the dated *Hiatella arctica* shells.

Hall Cemetery Series

A series of marine shell samples from Hall Cemetery, 1 km south of Wakefield on the north side of Route 105, Québec (45°37.33′N, 75°55.75′W) were collected by R.J. Fulton, C.G. Rodrigues and D.G. Fulton on April 13, 1985; submitted by R.J. Fulton.

GSC-4088. Hall Cemetery (I) 10 800 ± 110
$\delta^{13}C = -0.2‰$

The marine shells, sample FI83-3A (47.2 g dry weight; *Hiatella arctica*; identified by R.J. Fulton), at an elevation of 136 m, were treated with a 20% acid leach. The age estimate is based on one count for 5520 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 800 ± 110.

GSC-4056. Hall Cemetery (II) 11 100 ± 120
$\delta^{13}C = -1.4‰$

The marine shells, sample FI83-3B (48.0 g dry weight; *Macoma balthica*; identified by R.J. Fulton), at an elevation of 139 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2150 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 100 ± 120.

Comment (R.J. Fulton): The Hall Cemetery pit is figured and described as Stop C-2 of Fulton and Rodrigues, (1987). GSC-4088 is on shells collected from 1.5 m below the top of a pebbly silty clay, which was formed by marine bottom processes acting on the top of a bouldery diamicton. The bouldery diamicton, which is a glaciomarine deposit, provided *Portlandia arctica* shells that were dated at 11 760 ± 120 BP (TO-112R) by the AMS technique. GSC-4056 is on shells collected from 1.5 m above the base of a well stratified littoral sand, which overlies the pebbly silty clay. The sample that supplied GSC-4056 is the stratigraphically higher of the two samples and yet supplied the oldest date. The shells are in growth position and so could not have been reworked. There is no apparent explanation for this anomaly and possibly it is merely an indication of the level of accuracy that can be expected from shell dates. The dates indicate that the Gatineau Valley as far north as Wakefield had been deglaciated and invaded by Champlain Sea by 11 ka.

GSC-3812. Farrellton 11 700 ± 100
$\delta^{13}C = -1.4‰$

Marine pelecypod shells (RAB-81-37; *Macoma balthica* Linné; identified by S.H. Richard) from 4 km west of Farrellton, Gatineau County, Québec (45°45′0″N, 75°57′5″W), at an elevation of approximately 180 m, were enclosed in marine clay. The sample was collected by S.H. Richard on October 25, 1981; sample submitted by S.H. Richard.

The sample (35.8 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 700 ± 100.

Comment (S.H. Richard): GSC-3812 provides a minimum age for deglaciation of Gatineau valley as far north as Farrellton and dates marine invasion along this segment of the northern rim of the western Champlain Sea basin (Rodrigues and Richard, 1985). Dated marine molluscs were recovered from the upper 1 m of a silty, clayey dropstone mud deposit within 10 m of local marine limit inferred to be at about 190 m a.s.l. in this area. This is the highest elevation at which marine shells have been found along the western side of Gatineau valley. GSC-3812 is similar to a date of 11 900 ± 160 BP (GSC-1772) obtained near Martindale in the same area (some 6 km north of Farrellton) also on *Macoma balthica* shells in a sand deposit at an elevation of about 176 m, close to marine limit (Lowdon and Blake, 1973; Romanelli, 1975).

Comment (R.J. Fulton): In light of current publications on the timing of the marine invasion of the western basin of Champlain Sea and problems with dates near the limits of Champlain Sea (Anderson, 1988; Rodrigues, 1988) both GSC-1722 and -3812 are too old.

GSC-4201. Pakenham 11 100 ± 90
$\delta^{13}C = -1.4‰$

Marine pelecypod shells (85-ARNP-6; *Macoma balthica* Linné; identified by C.G. Rodrigues) from 7.1 km east of Pakenham, Ontario (45°20.75'N, 76°12.17'W), at an elevation of about 134 m, were collected by C.G. Rodrigues on July 19, 1985; submitted by S.H. Richard and C.G. Rodrigues.

The sample (46.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 100 ± 90.

Comment (C.G. Rodrigues): The shells of *Macoma balthica* are from pebbly sand overlying Paleozoic limestone. The pebbly sand was deposited in low salinity water (less than 25‰). GSC-4201 is slightly older than the date of 10 800 ± 130 BP (GSC-4168) for shells of *Macoma balthica* from a lower elevation (about 100 m).

GSC-4168. Galetta[1] 10 800 ± 130
$\delta^{13}C = -1.6‰$

Marine pelecypod shells (sample 85-ARNP-5; *Macoma balthica* Linné; identified by C.G. Rodrigues) from 1.0 km east of Galetta and 8.5 km east of Arnprior, Ontario (45°25.42'N, 76°14.67'W), at an elevation of approximately 100 m, were collected by C.G. Rodrigues on July 19, 1985; sample submitted by S.H. Richard and C.G. Rodrigues.

The sample (44.3 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 1 day and one 3 day count in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 900 ± 130.

Comment (C.G. Rodrigues): The sequence exposed at the site consisted of (1) ice-contact gravel and sand, (2) pebbly mud, (3) pebbly sand, (4) shell bed with pebbly sand matrix, and (5) gravel and sand. Invertebrate fossils were not observed in units 1 and 5. Foraminiferal and ostracode assemblages from the fossiliferous portion of the sequence indicate a succession from low salinity (lower part of Unit 2) to maximum salinity (middle part of Unit 2) to decreasing salinity (upper part of Unit 2 to Unit 4) conditions.

The *Macoma balthica* shells are from the shell bed with pebbly sand matrix (Unit 4), which is related to the final stages of marine submergence of the site. GSC-4168 is older than was expected; it is also older than the date of 10 400 ± 80 BP (GSC-2418; Lowdon and Blake, 1979) for the collagen fraction of bones of the white whale (*Delphinapterus leucas* Pallas) from an elevation of about 107 m, at the Pakenham site (45°22.24'N, 76°20.42'W).

Douglas Series

Freshwater and marine pelecypod shells were collected from the lower part of a delta 7.0 km east of Douglas and 12 km west-northwest of Renfrew on the north side of the Bonnechere River valley, Ontario (45°30'30"N, 76°51'0"W) at an elevation of approximately 120 m, by C.G. Rodrigues, S.H. Richard, and R.J. Fulton on August 25, 1982; submitted by S.H. Richard and C.G. Rodrigues.

GSC-3852. Douglas (I) 11 400 ± 400
$\delta^{13}C = -6.3‰$

Freshwater pelecypod shells (sample RAB-82-31-A; *Lampsilis*; identified by C.G. Rodrigues and S.H. Richard, 10.3 g dry weight) were treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two 1 day counts in the 2 L counter with a mixing ratio of 4.55.

The uncorrected age is 11 400 ± 400.

Comment (C.G. Rodrigues): The occurrence of freshwater pelecypod shells in sand at the Douglas site was first reported by Barnett and Clarke (1980). GSC-3852 is older than the dates of 10 200 ± 90 BP (GSC-1968; Lowdon and Blake, 1976) for *Lampsilis* sp. from an elevation of 53 m, at the Bourget site and 10 300 ± 90 BP (GSC-3235; Lowdon and Blake, 1981) for *Lampsilis radiata*, Gmelin, from an elevation of 61 m, at the Vankleek Hill site. The *Lampsilis* shells at the Bourget and Vankleek Hill sites are related to post-Champlain Sea fluvial environments and those at the Douglas site may be related to the outflow of freshwater from Lake Algonquin into Champlain Sea via the North Bay outlet. However, GSC-3852 is older than the estimate of 10.4 ka or later proposed by Karrow et al. (1975) for the opening of the outlet.

GSC-3872. Douglas (II) 11 700 ± 120
$\delta^{13}C = -3.6‰$

Marine pelecypod shells (sample RAB-82-31-B; *Macoma balthica* Linné; identified by W. Blake, Jr., 26.0 g dry weight) were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one 3 day count in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 700 ± 120.

Comment (C.G. Rodrigues): The *Macoma balthica* shells are from sandy mud clasts in the deltaic sand that contains shells of the freshwater *Lampsilis* sp. The clasts were probably reworked from a marine unit at a higher elevation. The mean value of GSC-3872 is greater than that of GSC-3852, however, the ranges of GSC-3872 and GSC-3852 overlap.

[1] The location of the Pakenham site was incorrectly listed as 46°22.24'N, 76°20.42'W in Lowdon and Blake (1979).

Ontario

Beaver River Series

A series of peat samples from the north bank of the Beaver River, central Hudson Bay Lowlands, Ontario (88°19.5'N, 55°55.5'W), at an elevation of approximately 33 m, were collected by P. Wyatt on July 15, 1985; submitted by P. Wyatt.

GSC-4146. Beaver River (I) >38 000
$\delta^{13}C$= -27.9‰

The peat sample 85HBL005 (35.5 g dry weight), was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 4320 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4154. Beaver River (II) >43 000

The peat sample 85HBL005 bottom (35.5 g dry weight), was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4423 HP. Beaver River (III) >51 000

The peat sample 85HBL005 top (220.5 g wet weight), was treated with hot base, hot acid, and distilled water rinses. The age estimate is based on two counts for 5370 minutes (two 2 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (P. Wyatt): Sample GSC-4423 was taken near the top of a 0.75 m band of well preserved peat. The peat accumulated in an abandoned river channel, which was cut into the underlying till. This sequence is overlain by till and postglacial Tyrrell Sea deposits. Fluvial gravels underlie the peat in the paleochannel. Shell fragments in this gravel have total amino acid ratios characteristic of presumed early Wisconsin marine deposits. The ratios are significantly lower than those determined for shell from presumed last-interglacial Bell Sea deposits. The shell fragments found in the subpeat fluvial gravels were derived from marine sediments, which have been dated by thermoluminescence at 74 000 ± 10 000 BP. Given the ^{14}C age of greater than 51 000 BP it is likely that the peat accumulated late in oxygen isotope stage 5 and is possibly St. Pierre equivalent. Initial results of floral and faunal analysis by R.J. Mott and J.V. Matthews, Jr. of the GSC show populations similar to the modern environment and are inferred to indicate a climate similar to present (not tundra conditions).

McKay Lake Series

A series of lake sediment samples from McKay (Hemlock) Lake, about 2.25 km northeast of Rideau Falls, Rockcliffe Park (Ottawa), Ontario (45°27.2'N, 75°17.9'W), at an elevation of approximately 46 m, were collected by S.R. Brown, J.P. Smol, and R. McNeely on March 20, 1985; submitted by R. McNeely.

GSC-4141. McKay Lake (I) 3840 ± 80
$\delta^{13}C$= -34.6‰

The lake sediment, gyttja sample 85-MB ML:85.03.20 191-199 cm (16.0 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2140 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 3990 ± 80.

GSC-4087. McKay Lake (II) 4820 ± 80
$\delta^{13}C$= -30.8‰

The lake sediment, gyttja sample 85-MB ML:85.03.20 343-347 cm (9.0 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4910 ± 80.

GSC-4078. McKay Lake (III) 6430 ± 80
$\delta^{13}C$= -30.1‰

The lake sediment, gyttja sample 85-MB ML:85.03.20 401-403 cm (18 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6510 ± 80.

GSC-4059. McKay Lake (IV) 8140 ± 100
$\delta^{13}C$= -32.5‰

The lake sediment, gyttja sample 85-MB ML:85.03.20 429-430 cm (41.6 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8260 ± 100.

Comment (R. McNeely): Sediment cores were taken through the ice in 10.5 m of water on March 4, 1983 and March 20, 1985 in the southern end of the deep basin of McKay Lake. The material was stored in the dark at 4°C until extruded, lyophylized and treated, in June 1985. These dates are part of a more extensive suite of samples of McKay Lake sediment that were dated to ascertain whether this calcareous lake was prone to "hardwater" error and to determine the magnitude of any errors detected.

The limnology of the lake has been described in Haffner and McNeely (1989) and a detailed discussion of the sedimentary column is in preparation. The sediment was dated at the base of the 4.3 m organic section and at defined biostratigraphic transitions in the sediment column. Two earlier dates on the sediment from this lake are available (GSC-621 and -622, Lowdon, Robertson and Blake, 1971). The more recent dates corroborate and refine this earlier data. A discussion of all the dates in relation to the 'hardwater' effect is in preparation.

South Gloucester Series

A series of marine shell samples from the west side of Highway 31 at the junction of Regional Road 8, (Spratt's Sand and Gravel pit), South Gloucester, 10 km east of Manotick, Ontario (45°16.7′N, 75°34.43′W), were collected by B.R. Rust on November 22, 1985; submitted by R.J. Fulton.

GSC-4173. South Gloucester (I) 10 500 ± 120
$\delta^{13}C$= +0.3‰

The marine shells, sample SG2 (47.3 g dry weight; *Hiatella arctica*; identified by R.J. Fulton), enclosed in sand and clay, at an elevation of 110 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2410 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 500 ± 120.

GSC-4166. South Gloucester (II) 11 100 ± 130
$\delta^{13}C$= +1.5‰

The marine shells, sample SG1 (50.5 g dry weight; *Hiatella arctica*; identified by R.J. Fulton), enclosed in sand and clay, at an elevation of 107 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 5240 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 100 ± 130.

Comment (R.J. Fulton): Both samples came from the top of a ridge of ice contact sand and gravel that was deposited as Late Wisconsinan ice retreated from the Ottawa area (Rust, 1987a). GSC-4166 was located at the base of a 3 m unit of sand and gravel with some thin clay interbeds, which had a general synclinal form. GSC-4173 came from the base of a 2 m thick coarse gravel, which overlay an unconformity that truncated the sand and gravel unit with the synclinal form. The synclinal form sediments are considered to be marine sediments that were deposited in a depression formed over a melting ice block (Rust, 1987b). GSC-4166 is a minimum age for both the retreat of ice from the area and for the invasion of Champlain Sea. The 2 m thick gravel at the top of the exposure is a littoral lag deposit and the unconformity at its base developed when the wave base intersected the ridge of ice contact deposits. GSC-4173 is a minimum age for marine truncation.

GSC-4217. Lambs Pond 5040 ± 90
$\delta^{13}C$= -27.2‰

The lake sediment, gyttja sample AP-79-2D (479.5-485.5 cm), was collected by T.W. Anderson on September 28, 1979 from Lambs Pond, 10 km northwest of Brockville, Ontario (44°39′20″N, 75°48′20″W), at an elevation of 108.8 m; submitted by T.W. Anderson.

The sample (79.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2380 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.54.

The uncorrected age is 5080 ± 90.

Comment (T.W. Anderson): The ^{14}C date falls at the decline in the *Tsuga* (hemlock) pollen profile. The difference between this date and the estimate of 4.8 ka for the regional decline in hemlock (Davis, 1981), of about 0.24 ka provides a measure of the hardwater error associated with this date. See also four previous dates from Lambs Pond: GSC-3088, -3259, -3273, -3296 (McNeely, 1989).

GSC-4179. Redpine Lake 10 200 ± 160
$\delta^{13}C$= -28.5‰

The lake sediment, basal gyttja sample AP-3-81 (499-509 cm), was collected by T.W. Anderson on July 15, 1981 from Redpine Lake, 16 km southwest of Barry's Bay and 62 km southwest of Pembroke, Ontario (45°34.1′N, 77°50.5′W), at an elevation of 351.7 m; submitted by T.W. Anderson.

The sample (195.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.88.

The uncorrected age is 10 300 ± 160.

Comment (T.W. Anderson): The sample provides a minimum age for deglaciation of Madawaska Highlands above St. Patrick Fault.

GSC-3684. Emerald Lake 8760 ± 140
$\delta^{13}C$= -27.5‰

The lake sediment, basal gyttja sample CGC-44 (634-645 cm), was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 30, 1983 from a circular kettle pond, 100 m in diameter, 1 km west of Emerald Lake, Ontario (46°47′50″N, 79°19′W), at an elevation of 315.0 m; submitted by J.J. Veillette.

The sample (30.2 g wet weight) was treated with base and acid at University of Montreal. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.19.

The uncorrected age is 8800 ± 140.

Comment (J.J. Veillette): The site lies above the limit reached by glacial Lake Barlow. The small steep sided kettle has favoured the formation of a thick gyttja with abundant wood fragments. A 6.45 m long core was recovered in 2.10 m of water. A 15 cm marl layer, derived from the slightly calcareous gravels of the Lake McConnell Moraine, has accumulated at the base of the gyttja sequence (Veillette, 1988). Pollen analysis has shown that the lower part of the regional palynological sequence is under-represented at this site (Richard et al., 1989).

GSC-3683. Mulock Lake 6960 ± 120
$\delta^{13}C$= -28.6‰

The lake sediment, basal gyttja sample CGC-37 (375-385 cm), was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 28, 1983 from a circular pond, 100 m in diameter, 1.5 km southwest of Mulock Lake, Témiscamingue, Ontario (46°30′40″N, 79°21′25″W), at an elevation of 383.0 m; submitted by J.J. Veillette.

The sample (187.1 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.67.

The uncorrected age is 7020 ± 120.

Comment (J.J. Veillette): The site, in a bedrock basin, lies above the limit reached by glacial Lake Barlow. A 3.85 m long core was recovered in 3.30 m of water. The young age is believed to be caused by late meltout conditions (Veillette, 1988). Pollen analysis has shown (Richard et al., 1989) that the lower part of the regional palynological sequence is missing at this site.

GSC-3685. Tilden Lake 9630 ± 140
$\delta^{13}C$= -29.3‰

The lake sediment, basal gyttja sample CGC-38 (450-460 cm), was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 28, 1983 from a circular pond, 80 m in diameter, 4 km east of Tilden Lake, Ontario (46°34′57″N, 79°35′40″W), at an elevation of 338.0 m; submitted by J.J. Veillette.

The sample (185.4 g wet weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.40.

The uncorrected age is 9700 ± 140.

Comment (J.J. Veillette): The site, in a bedrock-till basin, is slightly below or in the vicinity of the limit reached by glacial Lake Barlow (Veillette 1988; Richard et al., 1989). A 4.80 m long core was recovered in 4.0 m of water.

GSC-3686. Cross Lake 10 000 ± 100
$\delta^{13}C$= -30.1‰

The lake sediment, basal gyttja sample CGC-39 (927-938.5 cm), was collected by P.H. Richard, A. Larouche, and J.J. Veillette on March 28, 1983 from a nearly circular pond, 75 m in diameter, 1 km east of south end of Cross Lake, Ontario (46°50′N, 79°57′6″W), at an elevation of 306.0 m; submitted by J.J. Veillette.

The sample (213.5 g wet weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5820 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.25.

The uncorrected age is 10 100 ± 100.

Comments (J.J. Veillette): The site, in a bedrock basin, is slightly above the limit reached by glacial Lake Barlow. A 9.50 m long core was recovered at a water depth of 1.5 m. From 9.27-9.50 m there is a gradual transition from gyttja to clayey silt rhythmites that are slightly calcareous. This age is the third oldest age recorded in the lower Témiscamingue region (Veillette 1988; Richard et al., 1989).

GSC-3682. Lenore Lake 9580 ± 130
$\delta^{13}C$= -34.3‰

The lake sediment, basal gyttja sample CGC-40 (534-540 cm), was collected by P.J.H. Richard, A. Larouche, and J.J. Veillette on March 28, 1983 from a circular pond 175 m in diameter, 0.5 km north of Lenore Lake, Ontario (47°9′25″N, 79°58′38″W), at an elevation of 363.0 m; submitted by J.J. Veillette.

The sample (82.5 g wet weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5460 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.87.

The uncorrected age is 9730 ± 130.

Comment (J.J. Veillette): The site, in a bedrock basin, is above the limit reached by glacial Lake Barlow. A 5.40 m long core was recovered in a water depth of 4.90 m. The dated portion of the core is not the lowermost organic level, which was lost while pulling the sampler out of the water (Veillette 1988; Richard et al., 1989).

Timmins Series

A series of lake sediment and peat samples were submitted by R.N.W. DiLabio.

GSC-3875 HP. Timmins (I) >51 000

The organics and wood, sample SMO-65, depth 31.0 - 31.3 m (83.0 g dry weight; *Picea* or *Larix*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-25)), enclosed in laminated silt, from a 10 cm diameter core from a sonic drill hole, 35 km east-northeast of Timmins, Ontario

(48°33′30″N, 80°48′W), at an elevation of 240 m, were collected by N. Szabo in February of 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two (1 day) counts and one (3 day) count for 6700 minutes in the 5 L counter with a mixing ratio of 1.00.

Comment (R.N.W. DiLabio): This date is a minimum age for an organic-rich lake sediment unit that discontinuously underlies the Matheson till (Hughes, 1955) over an area of at least 2000 km^2, north and east of Timmins (DiLabio, 1982). Previously, a date of 37 ka (GSC-2148) was determined on compressed moss peat from this unit in Currie Township (Brereton and Elson, 1979), 18 km southeast of the site of GSC-3875. GSC-3875 indicates that the unit is either early Wisconsinan, agreeing with the interpretation (Andrews and Shilts, 1983) of deglaciation of the Hudson Bay basin during the Wisconsinan, or Sangamon, correlative with the Missinaibi Formation in the Moose River basin (Skinner, 1973). Correlation with the Missinaibi is preferred at present (DiLabio et al., 1988). Veillette (1986) has suggested that this date and other data indicate that only one major glaciation, represented by the Matheson till, occurred in Wisconsinan time in the Timmins area.

GSC-4491 HP. Timmins (II)
uncorrected 41 400 ± 720

The lake sediment, gyttja and silt sample 87 DDA 0998; hole 87-TIM-08 (42.5 g dry weight), enclosed in lacustrine silt, from a 10 cm diameter drill core at a depth of 23.9 - 24 m, 25 km northeast of Timmins, Ontario (48°39′14″N, 81°7′W), at an elevation of 267 m, was collected by R.N.W. DiLabio on January 29, 1987. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 6330 minutes (one 5 day) in the 5 L counter with a mixing ratio of 1.28.

Comment (R.N.W. DiLabio): The sample is from near the top of a widespread 3-8 m thick organic-rich lacustrine unit directly beneath the Matheson Till. This unit discontinuously underlies an area of at least 2000 km^2 and may represent a complete Sangamon or early Wisconsinan nonglacial cycle. This unit is correlated with the Missinaibi Formation of the Moose River basin (Skinner, 1973) and has been informally named the "Owl Creek" beds (DiLabio et al., 1988). Two other dates on the unit are nonfinite: greater than 37 000 BP (GSC-2148, Brereton and Elson, 1979) and greater than 51 000 BP (GSC-3875, DiLabio et al., 1988). GSC-4491 is considered to be a minimum date.

Laboratory comment (R. McNeely): The sample had a low carbon content and consisted of very fine detritus, for these reasons, a base treatment was omitted. Four separate burns were required (rather than two for normal samples and backgrounds), and the sample had to be mixed with dead gas for counting - each of which introduces potential contamination. The age is therefore considered anomalous.

Keswick Marsh Series

A series of wood and organic samples from Keswick Marsh, Lake Simcoe, Ontario (44°11′30″N, 79°30′30″W), at an elevation of 221.0 m, were collected by H. Dinel on May 26, 1982; submitted by H. Dinel.

GSC-3938. Keswick Marsh (I)
uncorrected 2889 ± 130

The organic detritus sample 82-211 (2.2 g dry weight), enclosed in fine woody material, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 4.01.

GSC-3859. Keswick Marsh (II)
uncorrected 2950 ± 100

The wood detritus, sample 82-210 (2.5 g dry weight; *Ulmus*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-16)), enclosed in woody material, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2340 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.48.

Kitchener Series

A series of wood samples were submitted by R. McNeely.

GSC-4352. Kitchener (I) 5720 ± 70
$\delta^{13}C$= -27.2‰

The wood sample 87-MIB-1 (8.4 g dry weight), from the west bank of Goulais River, 1 km north of Kirby's Corner, beside old Highway 17, Ontario (46°43′N, 84°17′W), was collected by B.G. Warner and P.F. Karrow on May 23, 1986 and was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 6600 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5750 ± 70.

GSC-4371. Kitchener (II) 11 900 ± 140
$\delta^{13}C$= -26.7‰

The wood sample 87-M1B-2 (6.1 g dry weight; *Picea*; identified by J. Gonzales), enclosed in peat, from the corner of Victoria and Fisher-Hallman Road, Kitchener, Ontario (43°30′30″N, 80°32′30″W), at an elevation of approximately 366 m, was collected by B.G. Warner and P.J. Hebda on September 17, 1979 had no pretreatment. The age estimate is based on two counts for 2170 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 900 ± 140.

Comment (R. McNeely): Two wood samples (87-MIB-1 and 2) were provided by R. Aravena and dated at GSC. These samples allowed the Waterloo Radiocarbon Dating Laboratory to compare their new 'LKB Quantalus' liquid scintillation counter with the GSC's gas proportional counter with good results. An additional three CO_2 gas preparations from wood, organic detritus, and shells, had been dated at GSC, were provided to the Waterloo Lab to assist in developing the 'Carbosorb' (direct absorption) technique and allowing a comparison of standard and low carbon content samples dated by the benzene technique (Aravena et al., 1989). All the dates are tabulated below.

Lab number	Material	Age	Technique[1]
GSC-4371	wood	11 900 ± 140	GP
WAT-1685	wood	12 000 ± 90	B
GSC-4352	wood	5720 ± 70	GP
WAT-1502	CO_2 (4352)	5820 ± 370	C
WAT-1686	wood	5770 ± 80	B
Previous dates on this wood:			
BGS-498		6490 ± 100	B
WAT-977		6060 ± 720	B
WAT-1001		6440 ± 120	B
WAT-1013		6460 ± 160	B
WAT-1062		6380 ± 123	B
GSC-4201	shells	11 100 ± 90	GP
WAT-1486	CO_2 (4201)	11 250 ± 640	C
WAT-1593	CO_2 (4201)	10 900 ± 100	B
WAT-1609	CO_2 (4201)	11 100 ± 400	Bs
GSC-4194	organics	4410 ± 70	GP
WAT-1471	CO_2 (4194)	4490 ± 310	C
WAT-1594	CO_2 (4194)	4480 ± 80	B
WAT-1604	CO_2 (4194)	4190 ± 170	Bs
GSC-4155	wood	2440 ± 50	GP
WAT-1592	CO_2 (4155)	2510 ± 70	B
WAT-1602	CO_2 (4155)	2340 ± 150	Bs

[1]GP - gas proportional; B - benzene synthesis; Bs - Benzene synthesis (small sample size); C - 'Carbosorb'.

Note: The errors quoted for GSC dates are unconventionally 2 sigma, whereas, by convention the errors on WAT and BGS dates are 1 sigma. All ages are normalized to -25‰ $\delta^{13}C$.

GSC-4354. Severn River 6100 ± 70 $\delta^{13}C = +1.5‰$

The marine shell, paired valves of *Mya truncata* (Linné), identified by A. Aitken), were enclosed in fine sand at a depth of 2.0 - 2.3 m. Sample 86 HBL 009 was collected by H. Thorleifson on August 16, 1986 from the western bank of Severn River at Limestone Rapids, northern Ontario (55°25.3'N, 88°15.3'W), at an elevation of 60 m; submitted by H. Thorleifson.

The sample (45.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6070 ± 70.

Comment (H. Thorleifson): This age determination for a relative sea level of 60 m above present is compatible with regional sea level history. Additional data will be required to obtain an uplift curve and, after comparison with the Churchill, Cape Henrietta Maria, and Moose River Basin records, isobase orientations.

Comment (A. Aitken): The Severn River fauna consists of the following species:

Taxa	Depth range	Inferred environment
Axinopsida orbiculata	3-110 m	sandy substrates
Astarte (crenata?)	3-110 m	muddy substrates
Hiatella arctica	<50 m	epifaunal, attached by byssus to stones and shells
Mytilus edulis	<10 m	epifaunal, attached by byssus to stones and shells
Mya truncata	intertidal-10 m	sandy substrates
Mya pseudoarenaria	<20 m	sandy substrates
Clinocardium ciliatum	<50 m	muddy substrates
Macoma balthica	<20 m	mixed substrates of mud and sand
Macoma calcarea	<50 m	mixed substrates of mud and sand

Interpretation:

The number of small specimens suggest an in situ assemblage. Most of the bivalves inhabit water depths of less than 15 m. Abundant *Mya truncata*, with *Mytilus* fragments and valves of *Macoma balthica*, suggest an intertidal habitat. Most of the *Mya truncata* are greater than 8 years old, many are greater than 10 years, however, their small size suggests estuarine conditions.

Macoma calcarea and *Axinopsida orbiculata* are generally found at depths of 5-50 m, while *Hiatella arctica* is most abundant in the shallow subtidal zone down to 15 m depth. Their presence suggests that the fauna is intertidal to shallow subtidal (i.e., probably less than 15 m).

There is limited reworking, i.e., fragmentation of shells and incorporation of *Astarte crenata* valves into the assemblage.

WESTERN CANADA

Manitoba

GSC-4420 HP. Nelson River >49 000
$\delta^{13}C$= -24.5‰

The wood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-14)) was enclosed in sand. The Henday Section sample was collected by E. Nielsen and R.N.W. DiLabio on June 30, 1986, from the north side of Nelson River, Manitoba, approximately 2 km southwest of the new Limestone Dam (56°29′N, 94°7′W), at an elevation of 90 m; submitted by R.N.W. DiLabio and E. Nielsen.

The sample (38.2 g dry weight) was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on two counts for 6630 minutes (two 2 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (R.N.W. DiLabio and E. Nielsen): This date (cf. GSC-4471 HP) is on wood from a major nonglacial interval recorded at numerous sites in northeastern Manitoba. This interval, variously represented by the Gods River and Nelson River sediments, is correlated with the Missinaibi Formation in Ontario, based on pollen content and on aspartic acid ratios on wood. The date indicates these sediments are not of Middle Wisconsinan age and further suggests an Early Wisconsinan or more likely a Sangamon age.

Dawson Bay Series

A series of freshwater shell samples were obtained from the south shore of Dawson Bay, Lake Winnipegosis, Manitoba, at an elevation of 259 m, by E. Nielsen on June 28, 1985; submitted by E. Nielsen.

GSC-4138. Dawson Bay (I)
$\delta^{13}C$= +0.6‰
uncorrected 4870 ± 80

The freshwater gastropod shells, sample PR 39 (49.0 g dry weight; *Marstonia gelida*; identified by B. McKillop and E. Nielsen), were collected at 52°44.17′N, 100°47.58′W and were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2040 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4139. Dawson Bay (II)
$\delta^{13}C$= -0.5‰
uncorrected 4900 ± 70

The freshwater gastropod shells, sample PR 53 (48.0 g dry weight; *Marstonia gelida*; identified by B. McKillop and E. Nielsen), were collected at 52°44.67′N, 100°52.42′W (south shore of Dawson Bay) and were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on three counts for 3190 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (E. Nielsen): Both samples (GSC-4138 and -4139) came from abandoned beaches, 6 m above the present level of Dawson Bay, situated near the northern end of Lake Winnipegosis. The dates are comparable to a date of 5050 ± 100 BP (BGS-1126) on similar material from approximately the same elevation at Denbeigh Point, 70 km to the northeast. The three dates indicate that during the last 5.0 ka the northern part of Lake Winnipegosis has undergone approximately 6 m of uplift with respect to the outlet situated at the southern end of the lake.

Saskatchewan

Frenchman River Series

The Frenchman River Series consists of two samples taken from two locations along Frenchman River, southern Saskatchewan. GSC-4404 comes from along the riverbank, and GSC-4325 comes from a 10 m high cutbank.

GSC-4404. Frenchman River (I) 1370 ± 80
$\delta^{13}C$= -25.7‰

The wood charcoal, sample KS-185-86 (6.0 g dry weight; *Salix* and *Prunus*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-9)), was collected about 12 km downstream from Eastend townsite, 22 km south of Dollard (49°25′N, 108°36′W), at an elevation of 900 m, by V. Levson and L. Smith on July 27, 1986; submitted by R.W. Klassen.

The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2120 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.48.

The uncorrected age is 1380 ± 80.

GSC-4325. Frenchman River (II)
$\delta^{13}C$= -10.0‰
uncorrected 4340 ± 60

The freshwater shells, sample KJ-262-86 (40.3 g dry weight; *Lampsilis*; identified by J.E. Dale), were collected from Frenchman River approximately 2 km northeast of Ravenscrag townsite (49°30′N, 109°3′W), at an elevation of 948 m, by R.W. Klassen and V. Levson on July 23, 1986; submitted by R.W. Klassen.

The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on three counts for 4170 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (R.W. Klassen): GSC-4325 indicates substantial parts of the alluvial fans encroaching on the Frenchman valley bottom formed during the late Holocene and that the entire succession of sediments below the valley bottom was likely deposited during and following the Late Wisconsinan glaciation (Klassen, 1983).

Horseman Site Series

Three samples from two sites in southwestern Saskatchewan, one east of Kongeview, and the other southeast of Robsart, comprise the Horseman Site Series.

GSC-4098. Kongeview 9500 ± 80
$\delta^{13}C$= -28.9‰

The wood, sample KJ-12-85 (9.0 g dry weight; *Salix*; identified by H. Jetté, (unpublished GSC Wood Report No. 85-71)), was collected about 13 km east of Kongeview (49°13.33′N, 109°10.67′DW), at an elevation of about 1005 m, by R.W. Klassen on August 6, 1985; submitted by R.W. Klassen.

The wood was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4260 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9560 ± 80.

Peat samples were collected about 17 km south and 8 km east of Robsart (49°13′20″N, 109°10′40″W), at an elevation of 999 m, by R.W. Klassen on October 22, 1985; submitted by R.W. Klassen.

GSC-4266. Robsart (I) 10 200 ± 140
$\delta^{13}C$= -29.0‰

The peat, sample BH No. 1-85: (4.0)+(4.0-4.04) (247.4 g wet weight), was treated with cold base, hot acid (very calcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 140.

GSC-4273. Robsart (II) 10 000 ± 130
$\delta^{13}C$= -29.8‰

The peat, sample BH No. 1-85: (4.5)+(4.50-4.54) (282.8 g wet weight), was treated with hot base, hot acid (very strongly calcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 100 ± 130.

Comment (R.W. Klassen): The three samples come from a postglacial peat bed about 1 m thick sandwiched between overlying pond sediments (Delorme, 1986) and underlying gravel above till. GSC-4266 comes from the uppermost part and GSC-4273 and -4098 come from the middle zone of this peat bed.

Peat from the lower zone yielded an age (AMS) of 14 340 ± 100 BP (TO-310) and an age of 10 000 ± 130 BP (GSC-4273) from the middle zone. A piece of wood (*Salix*) from the middle zone, dated at 9500 ± 80 BP (GSC-4098), suggests the peat date is likely about 0.5 ka too great and that a date of 10 300 ± 140 BP (GSC-4266) on peat from the upper zone and 14 340 ± 130 BP (TO-310) on peat from the lower zone may be 1.0 ka too great. These dates, along with another AMS date (12 630 ± 80 BP; TO-316) on shells from a nearby moraine plateau, are particularly significant in that they are the first dates obtained from postglacial sediments in this region and suggest a Late Wisconsinan age for the drift surface (Klassen and Vreeken, 1987, Vreeken, 1985).

GSC-4675. Fleming Creek
$\delta^{13}C$= -5.5‰
uncorrected 14 000 ± 340

The freshwater shells, sample "Fleming Creek No. 1" (8.4 g dry weight; *Stagnicola elodes* (Say, 1821); identified by J. Dale), were collected on August 8, 1986 from a roadcut along Highway 21, 10 km south of the town of Maple Creek, southwestern Saskatchewan (49°20.00′N, 109°29.00′W) at an elevation of about 833 m, and were treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2410 minutes (two 1 day) in the 2 L counter with a mixing ratio of 3.07. The samples were collected by W.J. Vreeken and T.G. McCulloch; submitted by W.J. Vreeken and R.W. Klassen.

Comments (W.J. Vreeken): The site is located within low relief hummocky lake plain terrain, underlain by maximum of 50 m of silts and fine sands with diamicton intercalations and deposited in glacial Lake Downie. These freshwater gastropod shells were confined to a 10-cm stratum, about 2.5 m beneath the land surface, exposed in an otherwise nonfossiliferous 5 m thick sequence of normal faulted, planar- and crossbedded sands.

1. This date serves as a comparison for an accelerator date (TO-694), which gave an age of 13 120 ± 80 BP for a shell from the same species and from the same stratum. The average value of 13.5 ka is assumed to date the close of the existence of glacial Lake Downie.

2. Glacial Lake Downie occupied formerly glaciated terrain between the Green Lake end moraine, which marks the Late Wisconsinan terminus around nonglaciated parts of the Cypress Hills (Westgate, 1968; Vreeken, 1986; Klassen and Vreeken, 1987), and the Lethbridge moraine, which marks a pause during the Late Wisconsinan glacial retreat. These ice-marginal positions were abandoned in quick succession (Vreeken, 1989a, b).

The radiocarbon dates demonstrate that the Green Lake position was abandoned before 13.5 ka and that the Lethbridge position was abandoned between 13.5 and about 11.2 ka, the latter being the minimum age estimate for the Manyberries bed of Glacier Peak tephra, which was deposited on the Lethbridge moraine.

Gap Creek Series

A series of freshwater shell, wood, and charcoal samples were collected from Gap Creek, 9-10 km southwest of Maple Creek, southwestern Saskatchewan, by W.J. Vreeken and others.

GSC-4027. Gap Creek (I)

$\delta^{13}C = -9.3‰$

uncorrected 2940 ± 60

The freshwater shell, sample KJ-13-83 (1984), "Gap Creek Site 1" (27.1 g dry weight; *Sphaerium* cf. *simile* (Say, 1816); identified by J. Dale), was collected on August 20, 1984, from right bank of Gap Creek, 1200 m upstream from "The Weir" dam (49°51.33′N, 109°35.0′W) at an elevation of 785 m. It was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00. The sample was collected by W.J. Vreeken and B.M.J Friske; submitted by R.W. Klassen and W.J. Vreeken.

GSC-4422. Gap Creek (II) 7220 ± 80

$\delta^{13}C = -27.2‰$

The wood fragments, sample "Gap Creek Site 2" (26.4 g wet weight; *Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-17)), were collected on August 6, 1986, from left bank of Gap Creek, (49°51.05′N, 109°35.25′W) at an elevation of 790 m, and were treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00. The sample was collected by W.J. Vreeken and T.G. McCulloch, and submitted by W.J. Vreeken and R.W. Klassen.

The uncorrected age is 7270 ± 80.

GSC-4421. Gap Creek (III) 45 ± 50

$\delta^{13}C = -24.7‰$

The charred wood fragments, sample "Gap Creek Site 3B" (14.9 g wet weight; *Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-16)), were collected on August 6, 1986, from left bank of Gap Creek, (49°51.05′N, 109°35.25′DW), at an elevation of 792 m, and were treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 2500 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00. The sample was collected by W.J. Vreeken and T.G. McCulloch; submitted by W.J. Vreeken and R.W. Klassen.

The uncorrected age is 40 ± 50.

Comment (W.J. Vreeken): Fluvial incision of Gap Creek, 40 m below the plain of glacial Lake Downie, occurred between 13.5 and 7.65 ka (GSC-4675 and -4422). Shortly after this, part of the alluvial surface was buried beneath alluvial fan sediments issuing from a tributary valley. Subsequent rapid fan aggradation, inferred from the absence of buried soils, proceeded until some time after 6.8 ka. The fan toe was truncated by fluvial action before 2940 ± 40 BP (GSC-4027). The main alluvial surface in the valley is less than 2.94 ka and was incised by about 5 m in recent times. The youngest surface formed as a result of very recent aggradation (GSC-4421). These dates refer to postglacial fluvial sediments from the Gap Creek valley, between 9 and 10 km southwest from the town of Maple Creek. The basin upland is the bottom of glacial Lake Downie, at about 830 m elevation, and is separated from the present day stream bed, at about 788 m elevation, by three fluvially formed surfaces (L1, L2, and L3). The L3 surface, at 800 m, marks a relict alluvial fan underlain by 8 m of fine sandy fan sediments with an intercalation of 6.8 ka Mazama tephra, 5 m above the base. The fan unit is underlain by a 1.5 m thick unit of fluvial gravel and sand, with wood fragments (GSC-4422) in the top part, resting on bedrock. The L2 surface is a paired fluvial terrace at 795 m elevation and is the most extensive alluvial surface in the valley. It is underlain by a 4-7 m thick alluvial sand unit resting on the same gravelly sediment as is present beneath the fan sediment unit. The alluvial unit contains bivalve shells (GSC-4027) from 1 to 2 metres above its base. The L1 surface, at 793 m elevation, is a minor alluvial surface directly along the creek. Its sandy cut-and-fill sequence is 3 m thick and contains charcoal (GSC-4421) marking a hearth site at a depth of 30 cm.

Alberta

Strubel Lake Series

A series of organic lake sediment samples from Strubel Lake, 20 km south-southwest of Rocky Mountain House, Alberta (52°12′N, 115°0′W), at an elevation of 1080 m, were collected by C.E. Schweger and C. Mandryk in March of 1985; submitted by C.E. Schweger.

GSC-4218. Strubel Lake (I) $29\,700 \pm 1260$

$\delta^{13}C = -25.2‰$

The organic lake sediment, sample SL-8A (128.8 g dry weight), was strongly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.37.

The uncorrected age is $29\,700 \pm 1260$.

GSC-4220. Strubel Lake (II) $21\,800 \pm 570$

$\delta^{13}C = -25.1‰$

The organic lake sediment, sample SL-7A (169.6 g dry weight), was very calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.34.

The uncorrected age is $21\,800 \pm 570$.

GSC-3804. Vermilion Lake 9840 ± 120

$\delta^{13}C = -24.9‰$

The angiosperm charcoal was enclosed in silt and clay. Sample 153R12 Lot 19 Feature 103 was collected by J.M. White and D. Fedje on October 25, 1983, 5 km west of Norquay Interchange on the TransCanada Highway, Banff National Park, Alberta (51°10′ 36″N, 115°38′40″W), at an elevation of 1390 m; submitted by J.M. White and D. Fedje.

The sample (13.3 g dry weight) was moderately calcareous when treated with hot acid and distilled water; base treatment was omitted. The age estimate is based on one count for 7080 minutes (one 5 day) in the 2 L counter with a mixing ratio of 2.22.

The uncorrected age is 9840 ± 120.

Comment (J.M. White): GSC-3840 is from "Occupation 8" of a nine component archaeological site on the north side of Vermilion Lake, Banff National Park. Stratigraphic separation results from the accumulation of aeolian silt and debris flows. The site is dated by 34 scintillation counter and accelerator mass spectroscopy radiocarbon dates; basal cultural material is estimated to be 10.7 ka. A mean age of 10 070 ± 80 BP was calculated for "Occupation 8" using two AMS dates and one liquid scintillation date on bone and one AMS date on charcoal. GSC-3804 was obtained from a small sample of charcoal and appears slightly too young, probably because of the lack of base pretreatment. "Occupation 8" contains bones of sheep (*Ovis canadensis*), hare (*Lepus americanus*), bison (*Bison bison*), and deer (*Odocoileus* sp.), and lithic artifacts, but no culturally diagnostic artifacts.

GSC-4284. Copper Lake 11 000 ± 120
$\delta^{13}C$= -29.2‰

The lake sediment, organic mud (gyttja), was overlain by gyttja and underlain by tephra. Sample 'Copper Lake H' (4.48–4.52 m) was collected by J.M. White and G. Osborn in September, 1985 from Copper Lake beside Highway No. 1, 0.5 km southeast of Castle Junction (Highway nos. 1 and 93), Banff National Park, Alberta (51°15'35"N, 115°55'20"W), at an elevation of about 1448 m; submitted by J.M. White.

The sample (50.1 g wet weight) was calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 000 ± 120.

Comment (J.M. White): The sample overlies a tephra apparently compositionally identical to Mazama tephra. The date appears to be somewhat too old, probably because of uptake of old carbon by aquatic plants. AMS dates from other cores suggest that a very early Holocene date is correct.

GSC-4177. Grande Prairie
uncorrected 2030 ± 90

The charred wood and charcoal (*Pinus*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-79)) were enclosed in silt and sand. Sample 30.6.2-A was collected by D. Liverman on June 30, 1985, from a gravel pit operated by the Alberta Transportation Authority, directly east of Highway 40, 10.5 km south of Grande Prairie, Alberta (55°4.33'N, 118°48.5'W), at an elevation of 540 m; submitted by N.W. Rutter.

The sample (4.9 g dry weight) was slightly calcareous when treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.91.

Comment (D. Liverman for N.W. Rutter): The date is younger than anticipated, but is not surprising. The young date means that the time of stabilization of this particular dune is loosely bracketed between deglaciation and 2.0 ka. This is at least an advance over previous geological knowledge. The position of the sample (overlying a well developed soil horizon) suggests that the dunes are considerably older than 2.0 ka.

GSC-4623 HP. Simonette River >51 000
$\delta^{13}C$= -25.4‰

The wood (*Abies*; identified by H. Jetté (unpublished GSC Wood Report No. 88-17)) was enclosed in sand. Sample 87-1-C was collected by D. Liverman on July 16, 1987, from a section 30 m east of the road bridge on Simonette River, Forestry Trunk Road, 8 km south of Goodwin on Highway 40, Alberta (55°8'N, 118°12'W), at an elevation of 600 m; submitted by D. Liverman and N.W. Rutter.

The sample (111.9 g dry weight) was noncalcareous when treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 7590 minutes (one 5 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (D. Liverman): The date obtained is in conflict with a previous date of 37 010 ± 2690 BP (AECV-428-C) on wood from the same stratigraphic level. The sample consists of detrital wood fragments in fluvial sediments, and it is possible that it consists of fragments of a variety of ages. Sediments exposed in this section contain no material derived from the Canadian Shield and thus predate Laurentide glaciation in the area. If the greater than 51.0 ka date is considered representative of the sediments, then little control on Laurentide glacial history can be obtained from this section. However, the section is thought to correlate with the sediments exposed at Watino, where numerous radiocarbon dates suggest Middle Wisconsinan deposition (Liverman et al., 1989). Amino acid ratios obtained from wood at this section and at Watino indicate all samples are of similar age and thus this sample is likely Middle Wisconsinan also. The date then suggests that fluvial deposition commenced early in the Middle Wisconsinan, prior to 51.0 ka.

British Columbia

GSC-4010. Elk River Valley
uncorrected 7680 ± 120

The carbonaceous organic material was enclosed in silty sand gravel. Sample 122-C-1 (b) was collected by H. George in August of 1982 from in Elk River Valley, 1.3 km south-southeast of Hosmer, British Columbia (49°34'42"N, 114°58'10"W), at an elevation of approximately 1042.4 m; submitted by L.D. Dyke.

The sample (54.8 g dry weight) was treated with cold base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.37.

Comment (L.D. Dyke): Date used in Ph.D. thesis of H. George on the deglaciation of Elk River valley. It may represent the time of deposition of alluvial deposits subsequent to valley deglaciation.

GSC-3606. Elko
uncorrected 190 ± 60

The wood (*Pseudotsuga menziesii*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-14)) was enclosed in silt. Sample 155-0-2 B2 was collected by H. George in August, 1982 from lower Wigwam River, approximately 7.5 km southeast of Elko, British Columbia (49°16'12"N, 115°0'48"W), at an elevation of approximately 914.4 m; submitted by L.D. Dyke.

The sample (13.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1040 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (L.D. Dyke): Essentially modern wood fragment, perhaps buried in lacustrine silts by recent landslide.

Valley Copper Mine Series

A series of moss and wood samples from Valley Copper Mine, Highland Valley, 350 m west of Quilt anton Lake, 16 km west of Logan Lake, British Columbia (50°29.5'N, 121°2.5'W), were collected by J.J. Clague on April 26, 1985, at an elevation of approximately 1210 km; submitted by J.J. Clague.

GSC-4054. Valley Copper Mine (I) 7080 ± 100
$\delta^{13}C$= -36.1‰

The moss, sample CIA-85-15-2 (7.5 g wet weight), enclosed in calcareous mud, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2250 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.08.

The uncorrected age is 7260 ± 100.

Comment (J.J. Clague): The dated sample was collected from a wedge of calcareous lacustrine sediments exposed in a trench crossing the floor of a drained lake (McNaughton Lake). These sediments lens out in woody peat which dominates the middle part of the McNaughton Lake sedimentary sequence (Clague, 1988a). A tephra is present within the calcareous lacustrine sediments directly above the dated sample.

GSC-4050. Valley Copper Mine (II) 7580 ± 80
$\delta^{13}C$= -22.9‰

The wood, sample CIA-85-15-3 (10.8 g dry weight), enclosed in calcareous mud and peat, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2250 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7550 ± 80.

Comment (J.J. Clague): The dated sample was collected at the contact between peaty and woody organic sediments and underlying calcareous lacustrine sediments exposed in a trench crossing the floor of a drained lake (McNaughton Lake). GSC-4050 is a minimum date for an episode of channeling and peat deposition that may be related to lower water levels in McNaughton Lake, although other explanations are possible (Clague, 1988a).

GSC-4061. Valley Copper Mine (III) 8130 ± 100
$\delta^{13}C$= -31.3‰

The moss, sample CIA-85-15-7 (16.8 g dry weight), enclosed in calcareous mud and peat, was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 2460 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8230 ± 100.

Comment (J.J. Clague): The dated sample was collected at the contact of moss peat and underlying calcareous lacustrine sediments exposed in a trench crossing the floor of a drained lake (McNaughton Lake). GSC-4061 is a minimum date for an episode of channeling and peat deposition that may be related to lower water levels in McNaughton Lake, although other explanations are possible (Clague, 1988a).

GSC-4046. Valley Copper Mine (IV) 8330 ± 100
$\delta^{13}C$= -32.0‰

The moss, sample CIA-85-15-4 (22.0 g dry weight), enclosed in calcareous mud, was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 2610 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8440 ± 100.

Comment (J.J. Clague): The dated sample was collected from calcareous lacustrine sediments exposed in a trench crossing the floor of a drained lake (McNaughton Lake). GSC-4046 dates an early phase of marl deposition in McNaughton Lake, well after deglaciation of this part of Highland Valley (Clague, 1988a).

"Bullion" Series

A series of peat and wood samples from "Bullion" placer gold pit, 4 km west of Likely, British Columbia (52°37.4'N, 121°37.7'W), at an elevation of approximately 792 m, were submitted by J.J. Clague.

GSC-4124. "Bullion" (I) 41 500 ± 1740
$\delta^{13}C$= -27.8‰

The highly compressed wood, sample CIA-85-128-1 (11.9 g wet weight; *Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 85-96)), enclosed in organic-rich silty sand and sandy silt was collected by J.J. Clague on September 17, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 41 500 ± 1740.

Comment (J.J. Clague): The dated sample is from a 4 m thick nonglacial stratified unit that is underlain and overlain by drift. The overlying drift sequence was deposited during the Late Wisconsinan Fraser Glaciation and comprises, from bottom to top, glaciofluvial or glaciolacustrine sand and gravel, glaciolacustrine mud, and till. The underlying drift sequence consists of glaciolacustrine, gravel, sand and silt, and till. GSC-4124 indicates that (1) nonglacial conditions existed in this part of British Columbia during the Olympia Nonglacial Interval and (2) the surface drift is Late Wisconsinan in age (Clague et al.,1990).

GSC-4334. "Bullion" (II)
uncorrected 42 000 ± 2010

The peaty silt, sample CIA-85-128-7 (85.3 g dry weight), enclosed in peaty, silty sand and sandy silt, was collected by J.J. Clague, R.J. Hebda, and R. Powell on June 24, 1986. The sample was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 4220 minutes (two 2 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (J.J. Clague): This date, in conjunction with GSC-4124 (41 500 ± 1740 BP), indicates that organic-rich silt and sand lying between two drift sequences in the "Bullion" pit is Middle Wisconsinan in age (Clague et al., 1990). Drift overlying the organic sequence comprises advance glaciofluvial and glaciolacustrine sediments and till. This drift sequence was deposited during the Fraser Glaciation (Late Wisconsinan). Drift underlying the organic sequence consists of recessional glaciolacustrine sediments and till. These sediments were deposited prior to the Middle Wisconsinan.

GSC-4411 HP. "Bullion" (III) 46 300 ± 940
$\delta^{13}C$= -26.2‰

The wood, sample CIA-85-128-4 (39.1 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report 87-12)), enclosed in silty sand, was collected by J.J. Clague, R.J. Hebda and R. Powell on June 24, 1986. The sample was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 6740 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.08.

The uncorrected age is 46 300 ± 940.

Comment (J.J. Clague): The dated sample is from the same nonglacial stratified unit as GSC-4124 (41 500 ± 1740 BP) and GSC-4334 (42 000 ± 2010 BP). It was collected approximately 1 m below these two samples and confirms that the nonglacial sediments are Middle Wisconsinan in age (Clague et al., 1990).

GSC-4004. Cheam Indian Reserve 1 5010 ± 70
$\delta^{13}C$= -25.5‰

The wood (*Tsuga*; identified by H. Jetté (unpublished GSC Wood Report No. 84-56)) was enclosed in diamicton (landslide debris). Sample CIA-84-217 was collected by J.J. Clague on November 4, 1984 from Cheam Indian Reserve 1, Fraser Valley, 12 km east of Chilliwack, 4.5 km south of Agassiz, British Columbia (49°12.0'N, 121°46.2'W), at an elevation of approximately 38 m; submitted by J.J. Clague.

The sample (11.5 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2420 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5020 ± 70.

Comment (J.J. Clague): The dated wood was collected near the base of a 4 m thick unit of landslide debris, thought to be part of the Cheam landslide, which covers an area of several square kilometres east of Chilliwack. The Cheam landslide is crossed by the TransCanada Highway and Canadian National Railway line. At the date site, the landslide debris overlies more than 20 m of stratified sandy gravel and minor sand, probably of glaciofluvial origin. The date suggests that the Cheam landslide (or one phase of that landslide) occurred about 5.0 ka.

Vedder Crossing Series

A series of wood samples from the Chilliwack Valley, 12 km east of Vedder Crossing, British Columbia (49°5.1'N, 121°48.2'W), were collected by J.J. Clague and B. Blaise on August 21, 1986; submitted by J.J. Clague.

GSC-4355. Vedder Crossing (I) 16 000 ± 180
$\delta^{13}C$= -23.6‰

The wood, sample CIA-85-169-3 (3.8 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-56)), enclosed in sand at an elevation of approximately 168 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4260 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.45.

The uncorrected age is 15 900 ± 180.

GSC-4363. Vedder Crossing (II) 16 100 ± 150
uncorrected

The wood, sample CIA-85-169-2 (10.6 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-55)), enclosed in silty clay at an elevation of approximately 172 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (J.J. Clague): The dated wood was recovered from glaciolacustrine sediments in Chilliwack Valley, southwestern British Columbia. This date and GSC-4355 (16 000 ± 180 BP) indicate that this area was ice free and locally forested at 16.0 ka (Clague et al., 1988). This suggests that the Late Wisconsinan Cordilleran Ice Sheet reached its maximum extent in this region after 16.0 ka.

GSC-4102. Chilliwack River 11 500 ± 100
$\delta^{13}C$= -28.1‰

The wood (*Pinus ponderosa / contorta*; identified by H. Jetté (unpublished GSC Wood Report No. 85-36)) was enclosed in till. Sample 845367 was collected by I. Saunders in October, 1984 from 10 km east of Vedder Crossing on the north side of the Chilliwack River, British Columbia (49°5'N, 121°50.5'W), at an elevation of 360 m; submitted by M.C. Roberts.

The sample (11.3 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 5520 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 500 ± 100.

Comment (M.C. Roberts): This date establishes, in the Chilliwack River valley, a late advance of the Fraser Lowland ice lobe (Saunders et al., 1987).

Ryder Lake Series

A series of wood samples from the southern edge of Ryder Lake upland, 0.6 km north of Chilliwack River, 9 km east-southeast of Vedder Crossing, British Columbia (49°4.9'N, 121°50.6'W), were collected by J.J. Clague; submitted by J.J. Clague.

GSC-4041. Ryder Lake (I) 11 200 ± 90
$\delta^{13}C$= -26.8‰

The wood, sample CIA-85-3 (11.5 g dry weight; *Pinus contorta*; identified by R. Mott (unpublished GSC Wood Report No. 85-17)), enclosed in till at an elevation of approximately 310 m, was collected on April 4, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 200 ± 90.

GSC-4036. Ryder Lake (II) 11 300 ± 100
$\delta^{13}C$= -25.9‰

The wood, sample CIA-85-1 (8.5 g dry weight; *Abies*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-17)), enclosed in till at an elevation of approximately 310 m, was collected on April 4, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 300 ± 100.

Comment (J.J. Clague): The dated samples were collected from a woody layer separating two thick till units (each about 50 m thick). A discontinuous bed of tephra and a paleosol are associated with the organic layer. GSC-4041 and -4036 (wood from the same layer) indicate that there was a brief period of glacier recession in lower Chilliwack Valley between about 11.3 and 11.2 ka; this was followed by a readvance shortly after 11.2 ka, during which forest and an incipient soil were overridden by ice (Saunders et al., 1987).

GSC-4037. Ryder Lake (III) 11 200 ± 90
$\delta^{13}C$= -27.2‰

The wood, sample CIA-85-2 (11.3 g dry weight; *Abies*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-17)), enclosed in till at an elevation of approximately 316 m, was collected on April 4, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 200 ± 90.

Comment (J.J. Clague): Both the till containing the dated sample and an underlying, slightly older till (see GSC-4090) were deposited by a lobe of ice flowing southeastward into Chilliwack Valley from nearby Fraser Lowland (Saunders et al., 1987). At the time these tills were deposited, a piedmont glacier still covered eastern Fraser Lowland, and the Cordilleran Ice Sheet, although shrunken, probably still existed. The date indicates that the upper till at this site is no older than 11.2 ka. Because Fraser Lowland was completely deglaciated by 11.0 ka, GSC-4037 closely limits the time of till deposition (see also GSC-4036 and -4041).

GSC-4090. Ryder Lake (I[illegible]) 11 800 ± 110
$\delta^{13}C$= -25.7‰

The wood, sample CIA-85-85 (9.1 g dry weight; *Abies*; identified by H. Jetté (unpublished GSC Wood Report No. 85-37)), enclosed in till at an elevation of approximately 253 m, was collected on July 10, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2390 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 800 ± 110.

Comment (J.J. Clague): The dated sample was collected from the lower part of a thick Late Wisconsinan till. This till is overlain by a similar, slightly younger till, which yielded dates of 11 200 ± 90 BP and 11 500 ± 100 BP (GSC-4037, -4102). The two units are separated by a thin woody horizon, which gave dates of 11 200 ± 90 BP and 11 300 ± 100 BP (GSC-4041, -4036). Both tills were deposited by a lobe of ice flowing southeastward into Chilliwack Valley from nearby Fraser Lowland (Saunders et al., 1987). At the time the tills were deposited, a piedmont glacier still covered eastern Fraser Lowland, and the Cordilleran Ice Sheet, although shrunken, probably still existed. GSC-4090, in conjunction with GSC-4036 and -4097, indicates that the lower till is about 11.3-11.6 ka old. Glacier recession about 11.3 ka was followed by a readvance shortly after 11.2 ka, during which forest and an incipient soil were overridden by ice.

GSC-4097. Ryder Lake (V) 11 600 ± 90
$\delta^{13}C$= -26.9‰

The wood, sample CIA-85-87 (12.0 g dry weight; conifer; identified by H. Jetté (unpublished GSC Wood Report No. 5-73)), enclosed in lake silt at an elevation of approximately 250 m, was collected on July 10, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 600 ± 90.

Comment (J.J. Clague): The dated sample was collected from a 2 m thick unit of lacustrine silt, which is overlain by two thick Late Wisconsinan tills. The silt accumulated in a pond or lake (probably ice-marginal) immediately before the site was overridden by a glacier flowing southeastward into Chilliwack Valley from Fraser Lowland (Saunders et al., 1987). GSC-4097, in conjunction with other dates at this locality (GSC-4036, -4037, -4041, -4090 and -4102), indicates that this advance occurred shortly after 11.6 ka.

GSC-4101. Lillooet
uncorrected 1180 ± 110

The wood charcoal (*Pseudotsuga menziesii*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-65)) was enclosed in silt and sand. Sample 5 (Lillooet 17/05/85) was collected by J.M. Ryder on May 17, 1985 from about 2.7 km northeast of Lillooet town centre, and about 200 m west of the old road bridge over Fraser River, British Columbia (50°42.58'N, 121°54.92'DW), at an elevation of 230 m; submitted by J.M. Ryder and J.J. Clague.

The sample (1.5 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 4.07.

Comment (J.M. Ryder): The charcoal is from a cache pit excavated in Fraser River overbank silt by paleoindians. The silt is capped by a paleosol that is overlain by 2.5 m of fluvial sand and gravel, the upper surface of which now constitutes a terrace 28 m above river level. The date indicates a time when this site was occupied by humans; it provides a minimum age for the underlying silts and a maximum age for fluvial aggradation that resulted in burial of the cultural horizon. It also enables estimation of a minimum rate of downcutting for Fraser River during the past millennium (Ryder and Church, 1986).

Lightning Creek Series

A series of wood samples from Lightning Creek, 31 km east of Quesnel, British Columbia (53°1.5'N, 122°3.0'W), at an elevation of 911 m, were submitted by J.J. Clague.

GSC-4383. Lightning Creek (I) >40 000
$\delta^{13}C$= -29.1‰

The wood, sample CIA-86-257-3 (11.4 g dry weight; *Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 87-05)), enclosed in sandy silt and silty sand, was collected by J.J. Clague on September 30, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 7080 minutes (one 5 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4611 HP. Lightning Creek (II) >51 000
$\delta^{13}C$= -29.0‰

The wood, sample CIA-86-257-3 (49.6 g dry weight; deciduous; identified by R.J. Mott (unpublished GSC Wood Report No. 88-16)), enclosed in sandy silt and silty sand, was collected by J.J. Clague and B.E. Broster on June 21, 1987. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on four counts for 7950 minutes in the 5 L counter with a mixing ratio of 1.00.

Comment (J.J. Clague): The dated samples are from nonglacial lacustrine sediments that are overlain and underlain by drift. A paleosol is developed on till directly beneath the nonglacial beds. The lower part of the nonglacial sequence is organic-rich and contains abundant reworked weathered material. These sediments grade up into inorganic laminated lacustrine sediments, which, in turn, are overlain by deltaic(?) sand. The sand is unconformably overlain by the surface till (Late Wisconsinan). The nonglacial sequence at this site is older than 40.0 ka and may have been deposited during the early part of the Olympia Nonglacial Interval (Middle Wisconsinan). Alternatively, it may predate the Olympia interval.

GSC-3927. Williams Lake River

$\delta^{13}C = -6.0‰$

uncorrected 9030 ± 120

The freshwater gastropod shells (*Stagnicola proxima, Lymnaea stagnalis jugularis*; identified by M.F.I. Smith) were enclosed in calcareous silt and sand. Sample CIA-84-143 was collected by J.J. Clague on June 21, 1984 from Williams Lake River, 0.5 km west of Williams Lake, British Columbia (52°7.7'N, 122°9.1'W), at an elevation of 581-582.5 m; submitted by J.J. Clague.

The sample (12.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.85.

Comment (J.J. Clague): The sediments in which the shells occur accumulated in a lake that formed immediately after the Williams Lake area was deglaciated at the end of the Late Wisconsinan Fraser Glaciation (Clague, 1987). The date thus is a minimum for deglaciation of this area and a maximum for incision of the thick Quaternary fill in Williams Lake River valley.

GSC-4237. Mystery Creek 880 ± 100

$\delta^{13}C = -26.2‰$

The wood charcoal was enclosed in sand. Sample EN-MYST-1 was collected by S.G. Evans and J.J. Clague on August 26, 1985 from 12.25 km north-northeast of Whistler, off highway 99 beneath debris of Mystery Creek Rock Avalanche, British Columbia (50°13'40"N, 122°15'0"W), at an elevation of 518 m; submitted by S.G. Evans.

The sample (3.3 g dry weight) was treated with hot acid, and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.57.

The uncorrected age is 900 ± 100.

Lillooet Series

A series of wood and lake sediment samples from 80 km northwest of Lillooet, British Columbia, were submitted by J.J. Clague.

GSC-4157. Lillooet (I) 1000 ± 50

$\delta^{13}C = -21.9‰$

The wood charcoal, sample Heg (11.4 g dry weight; *Pseudotsuga menziesii*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-88)), enclosed in sand, at an elevation of approximately 850 m (51°19'N, 122°18.5'W), was collected by P. Jones in July of 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 950 ± 50.

Comments (P. Jones): The sample came from a depth of 75 cm in a stream cut section in fluvial sediments, which accumulated in a depression cut off by earthflow movement. Bridge River tephra (age 2.4 ka) was found near the base of the section at 3 m. This evidence suggests that an earthflow formed the depression prior to 2.4 ka and that the sedimentary environment remained unchanged until some time after 1000 ± 50 BP, at which point renewed movement altered the drainage pattern. Incision by contemporary drainage has cut sections where beds may be traced laterally for 20-30 m.

GSC-4149. Lillooet (II) 1200 ± 80

$\delta^{13}C = -22.9‰$

The wood sample "Flapjack" (3.0 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-89)), enclosed in gyttja, at an elevation of approximately 1515 m (51°15'N, 122°32.5'W), was collected by P. Jones in August of 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2200 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.67.

The uncorrected age is 1150 ± 80.

Comments (M.J. Bovis): This date is not considered meaningful because it was recovered from a depth stratigraphically lower than the Bridge River Tephra (2.4 ka). It is thought that the large fragment of wood was caught on the leading edge of the cover and moved to a lower stratigraphic position.

GSC-4164. Lillooet (III) 7280 ± 100

$\delta^{13}C = -23.0‰$

The wood charcoal, sample Lake F (Rm) (11.1 g dry weight; *Pinus*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-91)), enclosed in sand, silt, and clay, at an elevation of approximately 1800 m (51°13.75'N, 122°30'W), was collected by P. Jones in August, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2350 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7250 ± 100.

Comments (P. Jones): The sample was taken from a pit dug in sediments deposited in a recently drained lake at the margin of a large earthflow. This date marks the time at which the earthflow dammed a small valley because the charcoal occurred at the base of a bedded sequence of gravel to fine silt sized fragments. Another marginal depression gave a similar date (7520 ± 90 BP, GSC-4181), supporting this interpretation of the same earthflow.

GSC-4181. Lillooet (IV) 7520 ± 90

$\delta^{13}C = -26.9‰$

The lake sediment, gyttja sample RM-G675 (100.0 g dry weight), enclosed in sand, silt, clay, and fine organics, at an elevation of 1760 m (51°13'N, 122°30'W), was collected by

P. Jones in August, 1985. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7550 ± 90.

Comments (P. Jones): This date came from a depth of 6.75-6.80 m in a lake/bog and is consistent with a basal date (7.1-7.4 m) of 7770 ± 90 BP (Beta-14273). The depression was created when a large earthflow moved across a pre-existing small valley and dammed a creek. The date and interpretation is corroborated by a date from another marginal depression of the same earthflow (7280 ± 100 BP, GSC-4164).

GSC-4096. Summit Lake 9200 ± 100
$\delta^{13}C$= -26.7‰

The wood (*Populus*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-35)) was enclosed in gyttja. Sample CIA-85-83 was collected by J.J. Clague, R.J. Hebda, and R. Powell on June 14, 1985 from a peat bog, 2 km east of Highway 97 and 5 km north-northeast of Summit Lake, British Columbia (54°19.4'N, 122°36.6'W), at an elevation of approximately 753 m; submitted by J.J. Clague.

The sample (4.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4260 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.37.

The uncorrected age is 9220 ± 100.

Comment (J.J. Clague): GSC-4096 is a minimum date for deglaciation of this part of central British Columbia. The dated wood was collected from gyttja near the base of an organic sequence in a small bog (590-600 cm below bog surface, 15-25 cm above lowest organic sediments). Inorganic clayey silt, which directly underlies the organic sequence, was probably deposited shortly after the site was deglaciated. Deglaciation may have occurred about 1-2 ka earlier than 9.2 ka because about 15 cm of gyttja lie between the inorganic clayey silt and the dated horizon.

Fraser River Series

A series of wood and peat samples from Fraser River, approximately 0.9 km northwest of mouth of Cottonwood River, 16 km north-northwest of Quesnel, British Columbia, at an elevation of about 500 m, were collected by J.J. Clague on September 11, 1986; submitted by J.J. Clague.

GSC-4396. Fraser River (I)
uncorrected 930 ± 50

The peat, sample CIA-86-232 (63.6 g dry weight), overlain by colluvium and underlain by fluvial sand (53°7.4'N, 122°37.0'W), was treated with hot acid (moderately calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2090 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (J.J. Clague): The dated sample was collected from a peat bed that is overlain by landslide debris and underlain by postglacial fluvial terrace deposits. The landslide occurred after about 930 BP. Fraser River was flowing at or within a few metres of its present level before 930 BP (Clague, 1988b).

GSC-4415. Fraser River (II) 940 ± 70
$\delta^{13}C$= -25.9‰

The wood, sample CIA-86-231 (64.7 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-04)), enclosed in colluvium (53°7.5'N, 122°37.1'W), was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 950 ± 70.

Comment (J.J. Clague): The dated sample is from a woody layer, which is directly overlain and underlain by landslide deposits. The landslide deposits, in turn, lie on a postglacial river terrace. The date indicates that the earlier phase of landsliding occurred before about 940 BP and the later phase occurred after 940 BP. It also suggests that Fraser River was flowing at or within a few metres of its present level before 940 BP.

GSC-3919. New Westminster
uncorrected 9490 ± 250

The wood fragment (*Abies*?; identified by R.J. Mott (unpublished GSC Wood Report No. 84-26)) was enclosed in clayey silt with traces of sand. Sample B.H.2 (191.0'-192.5') was collected by Golder Associates in 1979 from Fraser River at New Westminster, British Columbia (49°12'30"N, 122°53'40"W), at a water depth of approximately 19 m; submitted by W.H. Mathews and R.H. Blunden.

The sample (2.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2110 minutes (two 1 day) in the 2 L counter with a mixing ratio of 4.05.

Comments (W.H. Mathews): The sample occurred 58 m below the top of the bridge pier, that is 39 m below the bed of Fraser River.

At 9.5 ka an estuary with marine influence extended past the site of New Westminster, British Columbia. Since then about 39 m of estuarine silt and deltaic to fluviatile sand has accumulated.

GSC-4364. Paradise Creek valley 8230 ± 110
$\delta^{13}C$= -25.1‰

The wood (white pine type; identified by H. Jetté (unpublished GSC Wood Report No. 87-03)) was found on the surface. Sample 86TD-21A was collected by H.W. Tipper on August 15, 1986 at the head of Paradise Creek valley, 0.6 km north-northeast of Castle Peak, Chilcotin Ranges, British Columbia (51°5.2′N, 122°57.8′W), at an elevation of approximately 2240 m; submitted by J.J. Clague.

The sample (11.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 2170 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8230 ± 110.

Comment (J.J. Clague): Conifer logs and branches such as the log that yielded GSC-4364 are common on the surface and in sediments above timberline in the Castle Peak area (Clague and Mathewes, 1989). A study of this wood and associated peat and colluvium has shown that local timberline from 9.1 to 8.2 ka was at least 60 m, and perhaps more than 130 m, higher than today.

Lulu Island Series

A series of samples from Gilley Road, eastern Lulu Island, Fraser River Delta, British Columbia were submitted by M.C. Roberts.

GSC-4275. Lulu Island (I) 1840 ± 160
$\delta^{13}C$= -29.2‰

The wood, sample D41-4.12 (1.8 g dry weight; *Abies*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-20)), enclosed in sand overlying silt (49°8.8′N, 123°11.6′W), at a depth of 2.30 m, was collected by H. Williams in August of 1985. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2140 minutes (two 1 day) in the 2 L counter with a mixing ratio of 3.79.

The uncorrected age is 1910 ± 160.

Comment (M.C. Roberts): This date was obtained from a core that penetrated the tidal marsh that fringes the margin of active tidal flats of Lulu Island. The date provides evidence of recent sedimentation rates of the progradation of the delta in the late Holocene (Williams and Roberts, in press).

GSC-4194. Lulu Island (II)
uncorrected 4410 ± 70

The organic detritus, sample D23-2.67 (19.5 g dry weight), enclosed in silt, at a depth of 1.19 m, was collected by M.C. Roberts and H. Williams in August, 1985. The following three samples were collected from a core drilled beside Gilley Road at 49°10.5′N, 122°58.3′W. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (M.C. Roberts): This date was obtained from a sample taken from the base of the surficial peat bed present over much of eastern Lulu Island, and the date establishes the commencement of peat accumulation (Williams and Roberts, 1990).

GSC-4238. Lulu Island (III) 5500 ± 70
$\delta^{13}C$= -29.8‰

The organic-rich silt (silt removed), sample D23-5.19 (37.2 g dry weight), enclosed in silt, at a depth of 3.55 m, was collected by M.C. Roberts and H. Williams in August, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5580 ± 70.

Comment (M.C. Roberts): This date from a sample located between GSC-4194 and -4255 provides details of the change in sedimentation rates in the silt unit. GSC-4238 and -4255 bracket a tephra bed occurring at a depth of 5.7 m a.s.l.; because of these enclosing dates the tephra is most likely Mt. Mazama (Williams and Roberts, in press).

GSC-4255. Lulu Island (IV)
uncorrected 7960 ± 140

The organic-rich silt (silt removed), sample D23-13.1 (29.4 g dry weight), enclosed in silt, at a depth of 11.71 m, was collected by M.C. Roberts and H. Williams in August, 1985. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (M.C. Roberts): This date was obtained from the base of a thick organic-rich silt unit (approximately 10 m thick). This silt unit is interpreted as containing both tidal marsh and floodplain overbank silt deposits.

The dates, from three levels in the core drilled beside Gilley Road (GSC-4194, -4238, -4255), provide evidence on the rate of sedimentation of this part of the Fraser River Delta during mid-Holocene (Williams and Roberts, 1990).

GSC-4226. Boundary Bay 3000 ± 70
$\delta^{13}C$= -0.7‰

The marine shell fragments (*Mytilus*; identified by W. Blake, Jr.) were enclosed in sand. Sample D9-3.65 was collected by M.C. Roberts and J.L. Luternauer in August, 1985 from Boundary Bay, British Columbia (49°3.5′N, 123°1.4′W), at a depth of 2.12 m; submitted by M.C. Roberts.

The sample (20.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2170 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 3010 ± 70.

Comment (M.C. Roberts): Once the prograding Fraser River delta incorporated Point Roberts into the deltaic depositional pile, Boundary Bay became an inactive part of the delta front. This date suggests that the Boundary Bay delta front was still active at 3.0 ka.

GSC-4117. Fraser River Delta 2860 ± 120
$\delta^{13}C = -1.6‰$

The marine shells (*Clinocardium nuttalii* (con.); identified by K. Conway) were enclosed in medium sand and shell fragments. Sample BB-453 was collected by J.L. Luternauer and M.C. Roberts on July 9, 1985 from south end of 72nd Street; sample taken 80 m seaward of the dyke, Boundary Bay, Fraser River Delta, British Columbia (49°3.56′N, 123°1.54′W), at a depth of 4.5 m; submitted by J.L. Luternauer.

The sample (9.2 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2010 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.48.

The uncorrected age is 2880 ± 120.

Comment (J. Luternauer): This sample defines average sedimentation rate (1.6 mm/a) and age of southern perimeter of delta, which has probably been isolated from fluvial discharge for several thousand years.

GSC-4014. Tsawwassen
uncorrected 1860 ± 120

The marine gastropod shells (*Thais lamellosa*; identified by K. Conway) were enclosed in sand. Sample SFU(D) 12-1050 was collected by M.C. Roberts and H. Williams on September 25, 1984 from southwestern corner of Highway 17 junction with Point Roberts Road north of Tsawwassen, British Columbia (49°2.5′N, 123°4.0′W), at a depth of 8.5 m; submitted by J.L. Luternauer.

The sample (5.2 g dry weight) was not pretreated. The age estimate is based on two counts for 2400 minutes (two 1 day) in the 2 L counter with a mixing ratio of 4.16.

Comments (M.C. Roberts): This date was obtained from shells found in a core. A previous date from a depth of 7.90 m yielded an age of 4860 ± 110 BP (Beta-11059). The discrepancy between these dates probably resulted from reamings being incorporated in the core.

GSC-4307. Cheekye River 670 ± 50
$\delta^{13}C = -25.5‰$

The wood charcoal (conifer; identified by R.J. Mott (unpublished GSC Wood Report No. 86-19)) was enclosed in coarse alluvial gravel. Sample EN-GAR-CHE7 was collected by S.G. Evans on August 8, 1985 from north bank of Cheekye River, 1.75 km northwest of Alice Lake north of Brackendale, British Columbia (49°47′24″N, 123°8′20″W), at an elevation of 122 m; submitted by S.G. Evans.

The sample (11.6 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2490 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 680 ± 50.

GSC-3886. Capilano River valley
uncorrected 21 800 ± 210

The wood (*Abies*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-23)) was enclosed in silt. Sample CIA-84-1 was collected by J.J. Clague and L.E. Jackson, Jr. on April 26, 1984 from Capilano River valley, 0.5 km north of north end of Capilano Lake, 13 km north of Vancouver, British Columbia (49°23.9′N, 123°8.8′W), at an elevation of approximately 170 m; submitted by J.J. Clague.

The sample (11.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (J.J. Clague): The dated wood was collected from glaciolacustrine sediments deposited during the early part of the Late Wisconsinan Fraser Glaciation. The lake was probably dammed by ice occupying the adjacent Fraser Lowland and Strait of Georgia. Glaciolacustrine sediments of similar age are present in other nearby valleys draining south from the southern Coast Mountains (e.g., Coquitlam Valley, Lynn Valley).

GSC-4150. Pantage Lake 9170 ± 210
$\delta^{13}C = -26.3‰$

The lake sediment, gyttja was underlain by inorganic lacustrine mud. Sample CIA-85-82-1 was collected by J.J. Clague, R.J. Hebda, and R. Powell on June 12, 1985 from a peat bog, 3 km northwest of the northwest end of Pantage Lake, 52 km northwest of Quesnel, British Columbia (53°14.4′N, 123°9.3′W), at an elevation of approximately 791 m; submitted by J.J. Clague.

The sample (42.4 g dry weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 4.28.

The uncorrected age is 9190 ± 210.

Comment (J.J. Clague): GSC-4150 is a minimum date for deglaciation of this part of central British Columbia. The dated sample is the lowest 5 cm of a 265 cm thick gyttja sequence in a postglacial bog. The gyttja sequence is overlain by 210 cm of peat (which extends to the surface of the bog) and is underlain by more than 75 cm of inorganic clayey silt. The latter probably accumulated shortly after the site was deglaciated.

GSC-3917. Roberts Bank
uncorrected 360 ± 80

The wood fragments (Angiosperm; identified by R.J. Mott, (unpublished GSC Wood Report No. 84-27)) was enclosed in muddy, coarse sand. Sample END-83D-058 (154-169 cm) was collected by T. Hamilton and J.L. Luternauer on July 12, 1983 from Roberts Bank, Fraser Delta, British Columbia (49°0.40′N, 123°12.76′W), at a depth of 99.5 m; submitted by T. Hamilton and J.L. Luternauer.

The sample (3.6 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.08.

Comment (T.S. Hamilton): On T.S. Hamilton's 1983 coring cruise to sample the substrates of Georgia Strait, this sample was collected from the western edge of the active sand wave field on the subtidal platform off Roberts Bank (Fraser River Delta). The sample marked the terminal depth of penetration of a vibrocore. This layer of woody debris stopped further penetration. Finding wood with an essentially modern date at this depth below the sandwave field confirms active reworking, possibly by tidal currents and storms.

GSC-3810. Iona Island 1120 ± 140
$\delta^{13}C$= -1.2‰

The marine pelecypod shells (*Saxidomus giganteus*; identified by W. Blake, Jr.) were enclosed in sandy silt 2 m below sediment surface, in a water depth of 7.5 m. Sample FD83C1A was collected by Klohn Leonoff Consulting Engineers on March 15, 1983 from 1900 m 352°T from west end of Iona Island sewage outfall channel causeway, British Columbia (49°12.2′N, 123°17.4′W); submitted by J.L. Luternauer.

The sample (4.0 g dry weight) was not pretreated. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 5.51.

The uncorrected age is 1140 ± 140.

Comment (J.L. Luternauer): Sampling and dating was carried out to determine the long term sedimentation rate at this site where a new submarine sewage pipeline was placed (pipeline serves Greater Vancouver). The estimated sedimentation rate is 1.8 mm per annum.

GSC-4298. Turbid Creek 1060 ± 60
$\delta^{13}C$= -24.2‰

The wood (*Thuja plicata*; identified by H. Jetté (unpublished GSC Wood Report No. 86-18)) was enclosed in a mudflow diamicton. Sample EN-CAY-TUR3 was collected by P. Jordan in September, 1985 from 650 m upstream from mouth of Turbid Creek where Turbid Creek flows into Squamish River, 43 km north of Squamish, British Columbia (50°4′30″N, 123°20′5″W), at an elevation of 240 m; submitted by S.G. Evans.

The sample (11.6 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2500 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 1050 ± 60.

Pemberton Series

A series of wood samples, enclosed in a mudflow diamicton, from the north side of Meager Creek, 55 km northwest of Pemberton, British Columbia (50°34′47″N, 123°27′15″W), at an elevation of 548 m, were collected by S.G. Evans on August 25, 1985; submitted by S.G. Evans.

GSC-4211. Pemberton (I) 3940 ± 70
$\delta^{13}C$= -24.0‰

The wood, sample EN-MEAG-M5 (11.2 g dry weight; *Pseudotsuga menziesii*; identified by H. Jetté (unpublished GSC Wood Report No. 86-9)), was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2320 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3930 ± 70.

GSC-4207. Pemberton (II) 4080 ± 70
$\delta^{13}C$= -24.9‰

The wood, sample EN-MEAG-M4 (11.8 g dry weight; *Pseudotsuga menziesii*; identified by H. Jetté (GSC Report No. 86-7)), was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2160 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4080 ± 70.

Meager Creek Series

A series of wood samples from the left bank of Meager Creek, British Columbia were collected by P.B. Read on October 1, 1983; submitted by P.B. Read.

GSC-3811. Meager Creek (I) 210 ± 50
$\delta^{13}C = -24.4‰$

The charcoal, sample R83-5-C14 (9.2 g dry weight), was obtained 6.75 km at 224° upstream from the mouth of Capricorn Creek (50°33′36″N, 123°29′36″W), at an elevation of 637 m. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2370 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 200 ± 50.

GSC-3736. Meager Creek (II) 460 ± 50
$\delta^{13}C = -22.6‰$

The wood, sample R83-8-C14 (11.5 g dry weight; *Tsuga*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-46)) was obtained 4.15 km at 192° from Pylon Peak, (50°33′39″N, 123°31′44″W), at an elevation of 736 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2440 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 420 ± 50.

GSC-3750. Meager Creek (III) 480 ± 50
$\delta^{13}C = -23.4‰$

The wood, sample R83-7-C14 (11.7 g dry weight; *Pseudotsuga menziesii*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-47)), was obtained 3.90 km at 174° from Pylon Peak, (50°33′44″N, 123°30′47″W), at an elevation of 681 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 460 ± 50.

GSC-3733. Meager Creek (IV) 1920 ± 50
$\delta^{13}C = -22.6‰$

The wood, sample R83-6-C14 (12.0 g dry weight; *Chanaecyparis nootkatensis*; identified by R.J. Mott (unpublished GSC Wood Report No.83-49)), was obtained 6.75 km at 224° upstream from the mouth of Capricorn Creek (50°33′36″N, 123°29′39″W), at an elevation of 640 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 1880 ± 50.

GSC-4290. Lillooet River 890 ± 80
$\delta^{13}C = -25.7‰$

The wood (*Abies*?; identified by H. Jetté (unpublished GSC Wood Report No. 86-17)) was enclosed in a mudflow diamicton. Sample EN-MEAG-SAL2 was collected by P. Jordan on September 5, 1985 from Lillooet River, above Salal Creek, 55 km northwest of Pemberton, British Columbia (50°41′12″N, 123°30′0″W), at an elevation of 670 m; submitted by S.G. Evans.

The sample (7.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2270 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 900 ± 80.

Nogood Creek Series

A series of wood samples, collected 55 km northwest of Pemberton, British Columbia, were submitted by S.G. Evans.

GSC-4264. Nogood Creek (I) 800 ± 70
$\delta^{13}C = -25.6‰$

The wood, sample EN-MEAG-NOG4 (11.3 g dry weight; *Alnus*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-13)), enclosed in cobble boulder gravel, from Meager Creek, just above junction with Nogood Creek (50°33′39″N, 123°31′56″W), at an elevation of 762 m, was collected by P. Jordan on September 6, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 800 ± 70.

GSC-4223. Nogood Creek (II) 900 ± 60
$\delta^{13}C = -22.1‰$

The wood, sample EN-MEAG-NOG5 (11.3 g dry weight; *Pseudotsuga menziesii*; identified by H. Jetté (unpublished GSC Wood Report No. 86-10)), enclosed in a mudflow diamicton, from Meager Creek, just above junction with Nogood Creek (50°33.65′N, 123°31.93′DW), at an elevation of 762 m, was collected by P. Jordan on September 6, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1100 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 850 ± 60.

GSC-4239. Nogood Creek (III) 990 ± 70
$\delta^{13}C = -23.5‰$

The wood, sample EN-MEAG-NOG2 (12.2 g dry weight; *Thuja plicata*; identified by H. Jetté (unpublished GSC Wood Report No. 86-15)), enclosed in a mudflow diamicton, from Nogood Creek (50°34′0″N, 123°30′47″W), at an elevation of

853 m, was collected by P. Jordan on September 4, 1985. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 960 ± 70.

GSC-4302. Devastation Creek 2170 ± 60
$\delta^{13}C$= -22.3‰

The wood (*Thuja plicata*; identified by H. Jetté (unpublished GSC Wood Report No. 86-14)) was enclosed in a mudflow diamicton. Sample EN-MEAG-DEV3 was collected by P. Jordan on September 4, 1985 from Devastation Creek, 55 km northwest of Pemberton, British Columbia (50°34′0″N, 123°33′44″W), at an elevation of 853 m; submitted by S.G. Evans.

The sample (12.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2500 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 2120 ± 60.

Fishpot Lake Series

A series of peat and gyttja samples from peat bog, 2 km east of Fishpot Lake, 11 km west of Nazko, British Columbia (52°56.9′N, 123°44.6′W), were collected by J.J. Clague and R.W. Mathewes on May 26, 1985; submitted by J.J. Clague.

GSC-4136. Fishpot Lake (I) 7100 ± 100
$\delta^{13}C$= -27.6‰

The peat with wood fragments, sample CIA-85-34-3 (5.9 g wet weight), enclosed in peat, at an elevation of approximately 1091 m, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.17.

The uncorrected age is 7140 ± 100.

Comments (J.J. Clague): The dated sample is a 2 cm thick slice of peat collected from directly above a layer of airfall lapilli tephra in a peat bog.

GSC-4129. Fishpot Lake (II) 7230 ± 130
$\delta^{13}C$= -27.1‰

The peat with wood fragments, sample CIA-85-34-2 (6.2 g wet weight), enclosed in peat, at an elevation of approximately 1091 m, was treated with hot acid (noncalcareous) and distilled water rinses. The age estimate is based on two counts for 2060 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.52.

The uncorrected age is 7260 ± 130.

Comment (J.J. Clague): The dated sample is a 2 cm thick slice of peat collected from directly beneath a layer of airfall lapilli tephra in a peat bog. The tephra, which occurs 330-336 cm below the surface of the bog, is a product of the last eruption of Nazko volcano 2.5 km to the south-southeast (Souther et al., 1987). GSC-4129, in conjunction with GSC-4136 (7100 ± 100 BP), shows that this eruption took place about 7.2 ka (Souther et al., 1987).

GSC-4116. Fishpot Lake (III) 9900 ± 90
$\delta^{13}C$= -29.1‰

The lake sediment, gyttja, sample CIA-85-34-6 (160.0 g wet weight), underlain by stony mud, at an elevation of approximately 1088 m, was treated with hot acid (slightly calcareous (shells)) and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 100 ± 90.

Comment (J.J. Clague): GSC-4116 is a minimum age for deglaciation of this part of central British Columbia. The dated sample is the lowest 7 cm of a 628 cm thick organic sequence in a postglacial bog. This organic sequence consists mainly of peat, although the lowest 61 cm is dominated by gyttja. The dated sample is directly underlain by stony clayey silt, which is probably of glacial origin. (Souther et al., 1987).

GSC-3889. Kirby Creek >41 000

The wood (coniferous; identified by R.J. Mott (unpublished GSC Wood Report No. 84-36)) was enclosed in varved glaciolacustrine clays, silts, and sand. Sample 4/84-KCL was collected by T.S. Hamilton on April 22, 1984 from east bank of Kirby Creek, approximately 15 km west of Sooke on Highway 14 and 1 km north of Orveas Bay on Juan de Fuca Strait, British Columbia (48°23.6′N, 123°53.3′W), at an elevation of 31.0 m; submitted by T.S. Hamilton.

The sample (14.7 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4260 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (T.S. Hamilton): This sample was collected to help date the local unconsolidated deposits on southern Vancouver Island. This varved sequence, greater than 15 m thick, is overlain by a boulder bed thought to correlate with the Late Wisconsinan. The 'cedar' log comes from the lower portion of the varved sequence, approximately 5 m above its basal unconformity with Eocene volcanics. As it is "undatably old", the varved deposits are interpreted to be a remnant from an earlier glacial cycle despite their proximity to nearby thick Wisconsinan deposits along the coast and closer to Sooke.

GSC-4137. Comox
uncorrected 9050 ± 100

The wood (*Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 85-92)) was enclosed in silty clay till. Sample WGS-84-1 was collected by W.G. Smitheringale on September 15, 1984 from 3.36 km north 75° east from Comox, British Columbia (49°40.86′N, 124°52.87′W), at an elevation of 1 m; submitted by W.G. Smitheringale.

The sample (11.8 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 2880 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

Fort Ware Series

A series of wood charcoal samples enclosed in fine sand and silt, from approximately 34 km southeast of Fort Ware, British Columbia were submitted by L. Leslie.

GSC-4080. Fort Ware (I)
uncorrected 510 ± 40

The wood charcoal, sample T 112 9 D 11.4 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-27)) at an elevation of approximately 800 m (57°10.52′N, 125°17.75′W) was collected by L. Leslie on August 16, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2270 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (L. Leslie): This date represents the maximum age of a windblown deposit, which occurs directly overlying the charcoal unit from where this sample was taken. The reason for dating this deposit was to determine if this deposit was associated with the last deglaciation of the Finlay River valley. The relatively young date indicates that the deposit occurred as a result of a later event some time after deglaciation. This deposit is more likely to be related to a period of downcutting, exposing sediments in a cutbank below from where the windblown sediments were derived.

GSC-4082. Fort Ware (II)
uncorrected 3440 ± 60

The wood charcoal, sample T 94 STOP No. 8 (11.5 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-28)) at an elevation of approximately 700 m (57°14.43′N, 125°24.28′W), was collected by L. Leslie on August 3, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2090 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4109. Fort Ware (III)
uncorrected 4090 ± 90

The wood charcoal, sample T 96 STOP #11A (11.0 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 85-26)) at an elevation of approximately 700 m (57°9.25′N, 125°16.50′W), was collected by L. Leslie on August 4, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2030 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (L. Leslie): This sample along with GSC-4082 provides a minimum age for the abandonment of two terrace surfaces. The reason for dating these terraces was to determine if they were related to the last deglaciation of the Finlay River valley. However, the results suggest that the terraces are too young and perhaps they may have been the result of tectonic activity or climatic changes.

GSC-4076. Long Beach
uncorrected 800 ± 70

The wood (*Abies*, Western Fir; identified by R.J. Mott (unpublished GSC Wood Report No. 85-02)) was overlain by a thin pebbly layer below sand and underlain by clay. Sample LB-1 was collected by E. Livingston on November 23, 1984 from Esowista Indian Reserve 3, northwest corner of Long Beach, 13 km southeast of Tofino, British Columbia (49°4.3′N, 125°46.7′W), at an elevation of approximately 2 m; submitted by E. Livingston.

The sample (4.1 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.34.

GSC-4155. Jacobsen Glacier 2470 ± 50
$\delta^{13}C$= -23.5‰

The wood (*Abies*; identified by H. Jetté (unpublished GSC Wood Report No. 85-94)) was enclosed in till. Sample JM:D was collected by J.M. Ryder and J.R. Desloges on July 18, 1985 from right lateral moraine of Jacobsen Glacier, 60 km southeast of Bella Coola, British Columbia (52°2.5′N, 126°4.0′W), at an elevation of 1370 m; submitted by J.M. Ryder.

The sample (11.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2350 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 2440 ± 50.

Comment (J.M. Ryder): The sample is from a zone of abundant, small wood fragments (former krumholz?) that lies along the contact between older and younger tills a few metres below the crest of the present lateral moraine. The date indicates the time when a forested older moraine was overridden by an advancing glacier.

GSC-4163. Borealis Glacier 20 ± 60
$\delta^{13}C = -26.2‰$

The wood (*Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 85-93)) was enclosed in silty clay and sand. Sample B:2 was collected by J.M. Ryder and J.R. Desloges on July 16, 1985 from 200 m outside Late Neoglacial terminal moraine of Borealis Glacier, 48 km southeast of Bella Coola, British Columbia (50°10′N, 126°7′W), at an elevation of 1418 m; submitted by J.M. Ryder.

The sample (11.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1190 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 40 ± 60.

Comment (J.M. Ryder): Wood was overlain by 2.0 m of outwash sand and gravel, and underlain by at least 0.25 m of silty clay, probably of lacustrine origin. Modern date suggests that aggradation occurred here during the recent recession of the Borealis Glacier from its Late Neoglacial terminal moraine.

Bella Coola Series

A series of samples from southeast of Bella Coola, British Columbia were submitted by K. Ricker.

GSC-4030. Noeick Valley 460 ± 50
$\delta^{13}C = -25.5‰$

The wood, log fragment sample KR-8a (lower) (10.7 g dry weight; *Salix*), enclosed in gravel and bouldery retreatal outwash from the right side of Noeick Valley, 32 km southeast of Bella Coola (52°10.33′N, 126°21.58′W), at an elevation of 540 m, was collected by K. Ricker on October 28, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2470 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 460 ± 50.

Comments (K. Ricker): As discussed by Ricker and Ricker (1986) the date infers the development of a retreatal outwash that followed an advance of Purgatory Glacier to an adjacent advance position demarcated by a prominent Late Neoglacial age terminal moraine. Because this glacier blocked Noeick Valley for at least a short time span, it is speculated that the glacier dammed a lake, which in turn drained by jokulhlaup activity upon cessation of ice advance. This resulted in the bouldery outwash which uprooted and then buried trees in this bouldery material (as was the case in the 1984 jokulhlaup from Ape Lake, which is 14.5 km upstream of this locality).

Thus, the Late (or latest) Neoglacial advance of consequence (it oscillates quite frequently on a lesser scale) began before 1490 A.D. (± 50 years), but likely within the late 14th or early 15th century.

GSC-4028. Ape Lake 770 ± 60
$\delta^{13}C = -26.2‰$

The wood, sample KR-12c (12.1 g dry weight), enclosed in silty clay, 50 km southeast of Bella Coola (52°5.33′N, 126°9.83′W), at an elevation of 1390 m, was collected by K. Ricker on October 30, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 790 ± 60.

Comments (K. Ricker): The sample of wood was collected about 4 m below the normal high water level of the lake, which was about 3 m below the top of the sublittoral sediments. The sample site was located near the shore. The presence of the log at this depth within the sediment indicates that Ape Lake has existed since the 12th century. Since the section extended on for at least 1 m below the level of the log, the age determined for the lake is a minimum.

Gilbert and Desloges (1987) have demonstrated a seismic thickness of 5 m of lacustrine sediment in the area of sample collection and have suggested an average sedimentation rate of about 1.0 mm/a between 1926 and 1984. This would then suggest that the upper levels of the lake have been in existence for several thousand years.

High lake levels can only be brought about by an extension of Fyler Glacier, which establishes an ice dam on the lake. Ryder and Thomson (1986) document a Garibaldi "phase" of Neoglaciation beginning about 6.0 ka, which lacked any significant contraction of the ice after the main period of ice advance. Given this, it is possible that perhaps the lake sediment record corroborates a theory for the "rebirth" of glaciers on Coast Mountains of British Columbia, as discussed by Ricker and Ricker (1986).

An alternate explanation for the dated wood is that the tree was a standing dead snag on the slopes above Ape Lake (for several centuries) and was subsequently carried into the lake by recent avalanche activity.

GSC-4191. Purgatory Glacier 480 ± 50
$\delta^{13}C = -25.5‰$

The wood (roots) (*Thuja plicata*?; identified by R. Mott (unpublished GSC Wood Report No. 86-4)) was enclosed in paleosol (till). Sample PG:D was collected by J.M. Ryder and J.R. Desloges on July 20, 1985 from terminal moraine of Purgatory Glacier, north side of Noeick River, 35 km southeast of Bella Coola, British Columbia (52°10′N, 126°21′W), at an elevation of 595 m; submitted by J.M. Ryder.

The sample (11.6 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2510 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 490 ± 50.

Comment (J.M. Ryder): Sample consists of in situ roots from a paleosol developed on strongly oxidized till and overlain by two younger tills that are separated by a second paleosol. The date indicates that the two younger tills are both of Late Neoglacial age and that their related glacier advances were separated by an interval of recession that was long enough, locally, for soil formation and forest growth to take place.

GSC-4029. Misty Lake
uncorrected 12 100 ± 130

The lake sediment was enclosed in dy or gyttja. Sample MISTY LAKE 735-740 was collected by I. Walker and B. Walker on August 18, 1984 from Misty Lake, 19 km southeast of Port Hardy, on the northeastern side of the highway, British Columbia (50°36.3'N, 127°15.7'W), at an elevation of 5 m; submitted by R.W. Mathewes.

The sample (16.6 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.35.

Comment (R. Mathewes): This basal date on the first organic materials deposited in Misty Lake should provide a minimum age for deglaciation of northeastern Vancouver Island. This site has been investigated for fossil chironomids (I.R. Walker), and pollen and plant macrofossil analyses have been undertaken to reconstruct vegetation and climatic history.

GSC-3734. Klastline River 8440 ± 80
$\delta^{13}C$= -26.4‰

The wood charcoal (*Populus*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-48)), sample R83-3-C14, was collected by P.B. Read on July 29, 1983 on the right bank of Klastline River at 330 m, 1.08 km upstream from its mouth, British Columbia (58°2'14"N, 130°45'54"W), at an elevation of 330 m; submitted by P.B. Read.

The sample (12.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8470 ± 80.

GSC-3808. Tahltan River
uncorrected 8350 ± 80

The wood charcoal (*Populus*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-13)), sample P83-1-C14, was collected by J.F. Psutka on July 13, 1983 from east side of Tahltan River, 1.4 km upstream from its mouth, British Columbia (58°1'16"N, 130°58'2"W), at an elevation of 275 m; submitted by P.B. Read.

The sample (13.0 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5760 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

Queen Charlotte Sound Series

A series of marine shells samples from 66.7 km northeast of Cape St. James, the southern cape of the Queen Charlotte Islands, British Columbia were collected by J.L. Luternauer and K. Conway on July 22 1984; submitted by J.L. Luternauer and K. Conway. These dates are part of a series being used to determine the Late Quaternary history of Queen Charlotte Sound. The GSC Radiocarbon Dating Laboratory in Ottawa and the IsoTrace Laboratory at the University of Toronto have both provided dates for this series.

GSC-4108. Queen Charlotte Sound (I) 10 900 ± 280
$\delta^{13}C$= +0.8‰

The marine shells, sample End84B-007-01 (470-472 cm) (4.7 g dry weight; *Macoma liparia* (Dall, 1916); identified by R. Reid), enclosed in sandy mud, at a bearing of 55° true from Cape St. James (52°16.70'N, 130°12.27'W), at a depth of 474 m, were not pretreated. The age estimate is based on two counts for 6520 minutes in the 2 L counter with a mixing ratio of 4.45.

The uncorrected age is 10 900 ± 280.

GSC-4210. Queen Charlotte Sound (II) 10 900 ± 360
$\delta^{13}C$= +1.7‰

The marine shells, sample End84B-004-04 (5.3 g dry weight; *Macoma brota*; identified by W. Blake, Jr.) enclosed in sandy mud, at a bearing of 60° true from Cape St. James (52°14.72'N, 130°9.05'W), at a depth of 327 m, was not pretreated. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 3.91.

The uncorrected age is 10 900 ± 360.

Comment (J.L. Luternauer): GSC-4108 dates a marine shell found at 470 cm in a piston core (END 84B-07) taken from the floor of Moresby Trough, a deep, glacially scoured trough in northern Queen Charlotte Sound (water depth = 474 m; core length = 565 cm). This sample dates the transition from dark grey (5Y4/1) glacial marine sandy silt to olive green (5Y4/3) silty mud. Postglacial sedimentation continued at this site until at least 4.8 ka based on TO-249 (4760 ± 70 BP, gastropod shell fragment at 118 cm in core END84B-07). The same transition is dated, at a different core site, by GSC-4210.

GSC-4115. Queen Charlotte Sound (III) 11 800 ± 120
$\delta^{13}C = -0.7‰$

The marine gastropod shells, sample End84B-004-01 (32.5 g dry weight; *Colus* (Buccinidae); identified by R. Reid) enclosed in muddy sand, at a bearing of 60° true from Cape St. James (52°14.72'N, 130°9.05'W), at a depth of 327 m, were not pretreated. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 800 ± 120.

GSC-4120. Queen Charlotte Sound (IV) 12 400 ± 290
$\delta^{13}C = -0.6‰$

The marine shells, sample End84B-004-03 (390-393 cm) (5.6 g dry weight; *Macoma calcarea* (Gmelin, 1791); identified by R. Reid), enclosed in muddy sand, at a bearing of 60° true from Cape St. James (52°14.72'N, 130°9.05'W), at a depth of 327 m, were not pretreated. The age estimate is based on one count for 4320 minutes (one 3 day) in the 2 L counter with a mixing ratio of 3.68.

The uncorrected age is 12 400 ± 290.

Comment (J.L. Luternauer and K. Conway): Marine shells, GSC-4120, -4115, and -4210, were all removed from the same piston core (END84B-04) at depths of 390 cm, 121 cm, and 5-9 cm, respectively. The core was taken in a water depth of 327 m on a gentle slope (less than 1°) of a deep (greater than 500 m), glacially scoured trough in northern Queen Charlotte Sound (total core length = 451 cm). These dates, together with TO-167 (12 020 ± 90 BP - marine shell, a *Macoma liparia* valve at 343 cm depth in END84B-04) give a sedimentation rate varying from 0.12-1.25 cm/a. GSC-4210 (10 900 ± 360 BP) dated the contact between dark grey (5y4/1) sandy silt and the overlying olive green (5y4/3) silty mud. Only 5-10 cm of sediment has accumulated at this site since 10.9 ka.

Much of the Queen Charlotte Islands and portions of the mainland coast were deglaciated by 12.7 ka (Clague, 1981). The sediments in cores END84B-04 and -07 below the 10.9 ka dates (GSC-4108 and -4210) thus probably represent ice distal glacial marine or reworked glacial marine deposits. No obvious ice rafted debris was found in either core.

Queen Charlotte Island Series

A series of peat, lake sediment, and wood samples from the Queen Charlotte Islands, British Columbia were submitted to the laboratory.

Kunghit Island Series

A series of wood and peat samples from 19 km north of Cape St. James lighthouse, on Kunghit Island, British Columbia (52°6.3'N, 131°2.5'W), at an elevation of about 465 m, were collected by R.W. Mathewes and I. Walker on July 18, 1984.

GSC-3972. Kunghit Island (I) 1860 ± 70
$\delta^{13}C = -27.0‰$

The peat, sample K-3; 115-120 cm (192.9 g wet weight), enclosed in well humified peat, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1060 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 1890 ± 70.

Comment (R.W. Mathewes): This date marks the transition from a woody detrital peat below to a course heath peat above, suggesting a recurrence surface. Pollen and plant macrofossils (identified by G. Quickfall) indicate a local vegetation change to bog.

GSC-3979. Kunghit Island (II) 4360 ± 60
$\delta^{13}C = -27.1‰$

The silty peat, sample K-2; 115-120 cm (253.6 g wet weight), enclosed in peat, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.0.

The uncorrected age is 4390 ± 60.

Comment (R.W. Mathewes): The basal organic matter, in vertical exposure, was sampled from an excavation at the edge of a drained peat pool. There were some living roots of pine in upper portions of exposure. This date, GSC-3990, and -4007 suggest that blanket bog development at this locality began during the mid-Holocene, probably in response to climatic change.

GSC-4007. Kunghit Island (III) 4660 ± 70
$\delta^{13}C = -24.4‰$

The wood (root), sample K-3 ROOT (11.5 g dry weight; *Pinus contorta*; identified by R. Mott (unpublished GSC Wood Report No. 84-55)), enclosed in silty, sandy, gravelly clay, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2180 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4650 ± 70.

Comment (R.W. Mathewes): This root is part of a stump exposed underneath a peat deposit. The spruce tree appears to have been killed by "drowning" caused by blanket bog formation on a former mineral soil surface. Along with GSC-3979 and -3990, this date shows that blanket bog formation began at this locality during the mid-Holocene, probably in response to climatic changes.

GSC-3998. Kunghit Island (IV) 5090 ± 70
$\delta^{13}C = -28.6‰$

The silty peat, sample K-3; 5-10 cm (177.2 g wet weight) enclosed in silty, sandy clay with organics, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5150 ± 70.

Comment (R.W. Mathewes): The site was on an exposed ridge on Kunghit Island, at treeline, with extensive peat and peat pool development. The sample is from a drained peat-pool edge, where a vertical profile was exposed. The sample was overlain by peat. Pollen and plant macrofossil analyses at this site by G. Quickfall document local succession of vegetation. This date and GSC-3979 suggest that blanket bog development at this locality began in the mid-Holocene, probably in response to climatic change.

GSC-3786. 'Argonaut Hill' bog 7890 ± 100
$\delta^{13}C = -29.6‰$

The sandy peat, with pebbles at base, was overlain by fibrous, woody peat. Sample 'Argonaut Hill Bog 225-232 cm' was collected by R.W. Mathewes and B.G. Warner on July 9, 1983 from northeastern corner of Graham Island, Queen Charlotte Islands, British Columbia (54°2'15"N, 131°42'45"W), at an elevation of 105.0 m; submitted by R.W. Mathewes.

The sample (116.2 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 3580 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7970 ± 100.

Comment (R.W. Mathewes): This basal date from a wetland developed on 'Argonaut Hill' defines the beginnings of local paludification. Wood and other macrofossils suggest that local forest was being replaced by wetland communities around this time.

GSC-4093. Cape Ball modern
$\delta^{13}C = -27.3‰$

The wood (*Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 85-66)) was enclosed in sandy gravel. Sample 85-A-1b was collected by R.W. Mathewes and G. Quickfall on July 17, 1985 from just south of Cape Ball, eastern Graham Island, 13 km north-northeast of Tlell, British Columbia (53°41.7'N, 131°52.5'W), at an elevation of approximately 2 m; submitted by R.W. Mathewes.

The sample (11.7 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1240 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 20 ± 50.

Comment (R.W. Mathewes): This piece of wood was found protruding from a compact, gravelly diamicton (probably ablation till) from the last ice advance on this part of Graham Island. It is obviously intrusive, although it was detached, and almost certainly represents a spruce root from trees growing on top of the sea cliff. No other roots were seen to penetrate the diamicton to this depth, which suggested that it may have been in situ, although it clearly is not.

GSC-4040. 'Hermit-Thrush Pond' 7180 ± 110
$\delta^{13}C = -27.9‰$

The lake sediment, gyttja, sample SC-1 (257-264.5 cm), was collected by R.W. Mathewes and I. Walker on July 29, 1984 from 'Hermit Thrush Pond' (informal name), 2.5 km south of Bonany Inlet, 2.5 km west of Anna Lake in Chrismyal Range, Queen Charlotte Islands, British Columbia (52°41.3'N, 131°54.4'W), at an elevation of 550 m; submitted by R.W. Mathewes.

The sample (20.7 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 2400 minutes (one 2 day) in the 2 L counter with a mixing ratio of 1.47.

The uncorrected age is 7230 ± 110.

Comment (R.W. Mathewes): This small cirque pond was sampled with a piston corer to provide a record of high elevation vegetation changes during the Holocene. The relatively young date suggests that this basin may have been dry prior to 7.2 ka, perhaps in response to a warmer and/or drier climate in the Early Holocene. Other sites are currently being investigated to test this possibility.

GSC-3969. Moresby Island 3290 ± 60
uncorrected

The wood (*Tsuga heterophylla*; identified by R.J. Mott (unpublished GSC Wood Report No.84-291), sample MB 08-08-84, was collected by D. Dunkley on August 8, 1984 from 5[illegible] 100 m from Carmichael Passage along an unnamed creek (first creek south of Chadsey Creek) on Moresby Island, British Columbia (52°59'N, 131°57'W), at an elevation of approximately 2 m; submitted by D. Dunkley.

The sample (11.2 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-3787. 'Geiko' bog 4070 ± 80
$\delta^{13}C = -28.3‰$

The humified peat, sample Geiko Bog 255-260 cm (61.4 g wet weight), overlain by peat and underlain by sand, from approximately 5.0 km northwest of Tlell on road to Port Clement, Queen Charlotte Islands, British Columbia (53°36'50"N, 132°0'30"W), at an elevation of 30.0 m, was collected by R.W. Mathewes and B.G. Warner on July 18, 1983. The sample was treated with hot acid (noncalcareous)

and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4120 ± 80.

Comment (R.W. Mathewes): This basal bog sample, along with others (i.e., GSC-3817, -3979, -3998, and -4007), is part of a series from the Queen Charlotte Islands that define times of local paludification of previously drier sites. The dates collectively suggest a mid-Holocene climatic change that promoted the development of blanket bogs on Queen Charlottes on different substrates and at different elevations.

'Drizzle Pit' bog Series

A series of wood and peat samples about 2 km north of Watun River crossing, British Columbia, were collected by R.W. Mathewes and B.G. Warner on July 12, 1983.

GSC-3709. 'Drizzle Pit' bog (I) modern
$\delta^{13}C$= -24.4‰

The wood, from a horizontal log 15 cm in diameter, sample Drizzle Pit Bog (11.5 g dry weight; *Thuja plicata*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-37)), enclosed in sandy, gravelly peat, from a gravel pit on road to Masset (53°54'30"N, 132°5'W), at an elevation of 55 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1020 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is modern.

Comment (R.W. Mathewes): At the time of collection, there was an indication, based on appearance, that this wood might not be associated with the outwash gravels below. The sample was dated anyway, in case it might provide new information on local glaciation. It is obviously modern, probably mixed with surface peat and placed in contact with gravels by heavy machinery activity in the gravel pit.

GSC-3817. 'Drizzle Pit' bog (II) 4200 ± 100
$\delta^{13}C$= -28.9‰

The fibrous peat with wood fragments, sample Drizzle Pit Bog 100-110 cm (30.0 g wet weight), overlain by peat and underlain by sand and gravel, from 50 m west of road to Masset (53°53'30"N, 132°5'30"W), at an elevation of 45 m, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4320 ± 100.

Comment (R.W. Mathewes): This basal date on a large blanket bog defines the beginning of local paludification, which converted forest to an open forested bog, wetland. Later succession converted the fen to bog, based on pollen and macrofossil analyses by G. Quickfall. A cemented hardpan is present in the mineral soil below. Although the cemented horizon contributed to a rising water table, other sites in Queen Charlotte Islands show similar paludification around 4-5 ka, suggesting climatic change as the ultimate cause of the wetland initiation.

GSC-3908. Boomchain Creek
uncorrected 6100 ± 80

The wood (*Abies*?; identified by R.J. Mott (unpublished GSC Wood Report No. 84-28)) was enclosed in marine sand. Sample 1-23-07-84 was collected by D. Dunkley on July 23, 1984 from approximately 650 m north of estuary along Boomchain Creek (just west of Boomchain Bay), Queen Charlotte Islands, British Columbia (53°3'N, 132°26'W), at an elevation of 3-7 m; submitted by D. Dunkley.

The sample (5.5 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.43.

GSC-3799. Nesto Peninsula 8840 ± 90
$\delta^{13}C$= -28.7‰

The limnic peat was underlain by a mineral substrate and overlain by peat. Sample 'Hanging Pool 215-228 cm' was collected by R.W. Mathewes and B.G. Warner in July, 1981 from Nesto Peninsula, just east of Hippa Island, Queen Charlotte Islands, British Columbia (53°33'N, 132°55'25"W), at an elevation of 46.0 m; submitted by R.W. Mathewes.

The sample (91.2 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8900 ± 90.

Comment (R.W. Mathewes): This sample is part of a series from Graham Island that dates the beginning of organic matter deposition in postglacial basins. When other samples from this and other regions are dated, it is hoped that the causes of wetland formation can be reconstructed, whether they are climatic change, soil drainage alteration, or biological factors. This date and others so far obtained suggest that peat deposition did not begin immediately after deglaciation.

Hippa Island Series

A series of lake sediment samples from the only lake on Hippa Island off the west coast of Graham Island, British Columbia (53°31'55"N, 132°58'25"W), at an elevation of 530.0 m, were collected by R.W. Mathewes and B.G. Warner on July 14, 1983; submitted by R.W. Mathewes.

GSC-3773. Hippa Island (I) 9780 ± 110
$\delta^{13}C$= -25.7‰

The lake sediment, diatomaceous gyttja, sample Hippa Lake 320-325 cm (97.2 g wet weight), enclosed in gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.67.

The uncorrected age is 9790 ± 110.

Comment (R.W. Mathewes): This 5 cm core segment dates a sediment change from a tan gyttja below to a dark brown gyttja above. The date appears to define the late glacial / Holocene transition. Pollen analyses at this site have been undertaken.

GSC-3760. Hippa Island (II) 11 100 ± 220
$\delta^{13}C$= -24.2‰

The lake sediment, clay gyttja, sample Hippa Lake 340-347 cm (96.2 g wet weight), overlain by clay gyttja and underlain by clay, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2440 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.35.

The uncorrected age is 11 100 ± 220.

Comment (R.W. Mathewes): The sample represents the earliest organic sediment deposited on top of a bluish pebbly clay and represents a minimum age for local deglaciation and lake formation. Fossil chironomids have been analyzed for this core (Walker and Mathewes, 1988), and fossil pollen grains are currently being investigated to provide a local vegetation and climatic history.

NORTHERN CANADA (MAINLAND)

Yukon Territory

Ross River Series

A series of moss and wood samples from about 110 km north-northwest from Ross River, Yukon Territory (62°48'N, 132°11'W), were collected by B. Ward and A. Campbell on June 12, 1986; submitted by L.E. Jackson, Jr.

GSC-4289. Ross River (I) 50 ± 80
$\delta^{13}C$= -25.7‰

The wood, sample BCW-12686-5 (8.0 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-25)), enclosed in diamicton and slide material at an elevation of 920 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2310 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 60 ± 80.

Comment (L.E. Jackson, Jr.): The samples were incorporated in the landslide during its initial stages of failure. This radiocarbon date corroborates dendrogeomorphological data, which indicates the landslide began during the latter half of the 19th century. Surprise Rapids Landslide is the largest retrogressive thaw slide in the Pelly River basin.

GSC-4301. Ross River (II) 60 ± 80
$\delta^{13}C$= -28.6‰

The wood, sample BCW-12686-2 (7.8 g dry weight; *Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-28)), enclosed in peat (paleosol) at an elevation of 915 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 120 ± 80.

Comment (L.E. Jackson, Jr.): The samples were incorporated in the landslide during its initial stages of failure. This radiocarbon date corroborates dendrogeomorphological data, which indicates the landslide began during the latter half of the 19th or early 20th century. Surprise Rapids Landslide is the largest retrogressive thaw slide in the Pelly River basin.

GSC-4305. Ross River (III) 70 ± 50
$\delta^{13}C$= -23.5‰

The wood, sample BCW-13686-1 (14.8 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-31)), enclosed in landslide diamicton (stony clay) at an elevation of 915 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2590 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 50 ± 50.

Comment (L.E. Jackson, Jr.): This sample further corroborates the rapid formation of the largest retrogressive thaw landslide in the Pelly River basin. Most of the failure over about 4 km^2 of this slide has occurred during the past 100 years.

GSC-4286. Ross River (IV)
uncorrected 330 ± 60

The moss (sphagnum), sample BCW-12686-1 (25.0 g dry weight), enclosed in peat (paleosol) at an elevation of 915 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2270 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (L.E. Jackson, *Jr.*): This date was obtained from moss buried by Surprise Rapids Landslide. It disagrees with GSC-4301 determined on *Salix* twigs from the same horizon. Moss material may predate the *Salix* twigs or may be in error because of the hardwater effect.

Snake River Series

A series of organic detritus and wood samples were collected on the Snake River, Yukon Territory; submitted by N.R. Catto.

GSC-3695. Snake River (I)
uncorrected 8510 ± 70

The organic detritus, sample HH-62-62 (82-1) (33.8 g dry weight), enclosed in silt, was collected by N.R. Catto on August 3, 1982, 175 km northeast of Mayo, (65°28'N, 132°26'W), at an elevation of 472 m. The sample was treated with cold base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 5820 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.0.

Comments (N.R. Catto): The organic detritus sample was obtained from a 2 cm thick detritus lens situated within an abandoned channel of a gravel dominated alluvial fan sequence, located at an elevation of 472 m. The alluvial gravel was underlain by till correlated to Hungry Creek Till recognized in the Bonnet Plume Basin.

The date suggests that fan construction in this locality began prior to 8.5 ka, which thus provides a minimum date for deglaciation. However, regional stratigraphic relationships suggest that deglaciation had occurred prior to this time.

Palynological analysis of material in the abandoned channel revealed an assemblage that had undergone at least two stages of degradation induced by fungal attack. The fungal remains had also been corroded by further fungal and/or chemical activity, so no identification of the fungal taxa was possible. The palynological assemblage that remained was dominated by *Lycopodium*, *Cystopteris*, Cyperaceae, and *Sphagnum* grains. No environmental conclusions are possible from this assemblage.

GSC-3697. Snake River (II)
uncorrected >39 000

The wood, sample HH-76-3d-9 (11.5 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-39)), enclosed in silt, was collected by N.R. Catto on July 23, 1982 from a river bluff, 45 km southeast of confluence of Snake and Peel rivers along the east bank of Snake River (65°48'N, 133°19'W), at an elevation of 360 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2370 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-3800. Snake River (III)
uncorrected >40 000

The wood, sample HH-76-3d-82-19 (12.3 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-12)), enclosed in silty sand, was collected by N.R. Catto on July 23, 1982 from a river bluff, 45 km southeast of confluence of Snake and Peel rivers along the east bank of Snake River (65°48'N, 133°18'W), at an elevation of 308 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 5370 minutes (two 2 day) in the 5 L counter with a mixing ratio of 1.00.

Comments (N.R. Catto): A single piece of wood was obtained from a silty sand unit, situated 48 m above Snake River, at an overall elevation of 308 m. The silty sand unit was contained within a 65 m thick sequence of fluvial sediments, which extended to the level of Snake River and was overlain by till of the most recent advance in the Snake River area.

A horizon 6 m below this unit contained a piece of *Picea* or *Larix* dated at 39 000 BP (GSC-3697). The fluvial unit is correlative to terrace deposits previously dated at 31 000 BP (GSC-181; Dyck et al., 1965) and 35 000 BP (GSC-2956; McNeely, 1989). Although these terrace deposits were not overlain by till, the regional stratigraphic relationships indicate that the area was glaciated subsequent to the fluvial event and that the till exposed at section HH 76-3d is correlative to Hungry Creek Till, exposed in Bonnet Plume Basin. This correlation, which implies that the fluvial deposits are older than 36.9 ka (GSC-2422; McNeely, 1989), is thus supported by the nonfinite dates obtained for GSC-3697 and -3800.

GSC-4091. Faro 6740 ± 60
$\delta^{13}C = -26.0‰$

The organic detritus was enclosed in sand and silt. Sample JJO-140685-1 was collected by L.E. Jackson, Jr. on June 14, 1985 from about 7 km (4.5 miles) north of Faro along the road to Cyprus Anvil Mine, Yukon Territory (62°15.5'N, 133°19'W), at an elevation of 910 m; submitted by L.E. Jackson, Jr.

The sample (20.0 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4110 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6760 ± 60.

Comment (L. Jackson, *Jr.*): The age determined on this sample documents the initiation of blanket bog growth in this area.

Jakes Corner Series

A series of lake sediment samples along the sideroad to Tarfu Campground off Atlin Road about 28 km south of Jakes Corner, Yukon Territory (60°4'N, 133°48'W), at an elevation of 760 m, were collected by L.C. Cwynar, M. Lacy, and J. Wood on July 22, 1983; submitted by L.C. Cwynar.

GSC-4212. Jakes Corner (I) 1210 ± 70
$\delta^{13}C$= -28.9‰

The lake sediment, mud sample Kettlehole-1 (60-68 cm) (65.8 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 1270 ± 70.

GSC-3826. Jakes Corner (II) 1520 ± 110
$\delta^{13}C$= -29.4‰

The lake sediment, mud sample Kettlehole-1 (86-91 cm) (61.1 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2370 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.87.

The uncorrected age is 1590 ± 110.

GSC-4190. Jakes Corner (III) 1920 ± 70
$\delta^{13}C$= -28.7‰

The lake sediment, mud sample Kettlehole-1 (110-115 cm) (49.3 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.29.

The uncorrected age is 1980 ± 70.

GSC-4178. Jakes Corner (IV) 2190 ± 70
$\delta^{13}C$= -31.6‰

The lake sediment, mud sample Kettlehole-1 (135-140 cm) (52.2 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2460 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 2300 ± 70.

GSC-3815. Jakes Corner (V) 2560 ± 110
$\delta^{13}C$= -29.8‰

The lake sediment, mud sample Kettlehole-1 (155-160 cm) (77.5 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 2650 ± 110.

GSC-4144. Jakes Corner (VI)
uncorrected 3110 ± 90

The lake sediment, mud sample Kettlehole-1 (175-180 cm) (56.1 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 1160 minutes (one 1 day) in the 2 L counter with a mixing ratio of 1.00.

GSC-4135. Jakes Corner (VII) 3370 ± 80
$\delta^{13}C$= -30.8‰

The lake sediment, mud sample Kettlehole-1 (195-200 cm) (58.1 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 3460 ± 80.

GSC-3816. Jakes Corner (VIII) 3710 ± 100
$\delta^{13}C$= -30.3‰

The lake sediment, mud sample Kettlehole-1 (220-225 cm) (82.0 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 3800 ± 100.

GSC-3837. Jakes Corner (IX) 4860 ± 90
$\delta^{13}C$= -30.7‰

The lake sediment, mud sample Kettlehole-2 (285-290 cm) (74.6 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2440 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4960 ± 90.

GSC-3836. Jakes Corner (X) 6560 ± 90
$\delta^{13}C$= -31.1‰

The lake sediment, mud sample Kettlehole-2 (340-345 cm) (82.8 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6660 ± 90.

GSC-4035. Jakes Corner (XI) 7860 ± 90
$\delta^{13}C$= -31.5‰

The lake sediment, mud sample Kettlehole-2 (370-375 cm) (68.6 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.09.

The uncorrected age is 7960 ± 90.

GSC-4128. Jakes Corner (XII) 8720 ± 120
$\delta^{13}C$= -33.1‰

The lake sediment, mud sample Kettlehole-2 (380-385 cm) (69.7 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2160 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.08.

The uncorrected age is 8850 ± 120.

GSC-4111. Jakes Corner (XIII) 9240 ± 110
$\delta^{13}C$= -32.2‰

The lake sediment, sample Kettlehole-2 (390-395 cm) (77.1 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9350 ± 110.

GSC-3833. Jakes Corner (XIV) 9630 ± 120
$\delta^{13}C$= -31.1‰

The lake sediment, mud sample Kettlehole-2 (400-405 cm) (78.8 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.15.

The uncorrected age is 9720 ± 120.

GSC-4104. Jakes Corner (XV) 10 500 ± 110
$\delta^{13}C$= -32.1‰

The lake sediment, mud sample Kettlehole-2 (412-416 cm) (58.0 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.34.

The uncorrected age is 10 600 ± 110.

GSC-3831. Jakes Corner (XVI) 11 300 ± 100
$\delta^{13}C$= -35.0‰

The lake sediment, mud sample Kettlehole-1/2 (423-426 cm) (106.6 g wet weight), was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4100 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 400 ± 100.

Carcross Series

A series of lake sediment samples from approximately 3.5 km southwest of Carcross, Yukon Territory (60°8′21″N, 134°44′30″W), at an elevation of 1015.0 m, were collected by L.C. Cwynar, R. Spear, and P. Carlyle on July 7, 1982; submitted by L.C. Cwynar.

GSC-3650. Carcross (I) 3660 ± 120
$\delta^{13}C$= -27.0‰

The lake sediment, noncalcareous gyttja sample FIR-6 (60-65 cm) (70.3 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.45.

The uncorrected age is 3690 ± 120.

GSC-3660. Carcross (II) 5730 ± 100
$\delta^{13}C$= -28.4‰

The lake sediment, gyttja sample FIR-5 (100-105 cm) (64.3 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.48.

The uncorrected age is 5780 ± 100.

GSC-3665. Carcross (III) 11 000 ± 170
$\delta^{13}C$= -17.4‰

The lake sediment, gyttja sample FIR-1 (393.5-398.0 cm) (51.3 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4020 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.20.

The uncorrected age is 10 800 ± 170.

Caribou River Series

A series of peat samples were collected in the region near the confluence of the Caribou and Peel rivers, Yukon Territory; submitted by N.R. Catto.

GSC-3690. Caribou River (I)
uncorrected 2290 ± 50

The peat sample HH-72-50 82-17 (59.6 g dry weight), enclosed in peat, was collected by N.R. Catto on July 25, 1982 from a river bluff 40 km southwest of the confluence (66°15′N, 134°58′W), at an elevation of 400 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comments (N.R. Catto): The sample of peat was obtained from the base of a 36 cm deep peat layer, which extended to the surface. The peat layer overlies 4.4 m of fluvial sediments, 4.7 m of till, and 6 m of gravel, and the site was located at an elevation of approximately 400 m.

The palynological assemblage present in this sample is dominated by Cyperaceae (sedges), with lesser amounts of *Picea* (cf. *mariana*) and *Sphagnum*. *Betula* (shrub), *Alnus* cf. *crispa*, *Empetrum*, *Myrica Gale*, and *Vaccinium* pollen grains are also present. The assemblage suggests a Cyperaceae (*Carex*?) bog. Palynological assemblages present in the overlying samples suggest progressive drying of the bog and replacement of the original assemblage by *Picea glauca*, *Betula*, and *Alnus crispa*. The drying trend could be caused by permafrost degradation, but no conclusions with respect to possible regional climatic change during this period can be drawn at present.

The underlying fluvial sediments contain palynomorphs indicating the progressive development of a mixed deciduous-evergreen forest community. On the basis of stratigraphic, sedimentologic, and topographic relationships, these fluvial sediments have been correlated to the uppermost portion of the fluvial sediments exposed downstream at HHC 82-1c. A sample of *Salix* wood from the sediments at HHC 82-1c has yielded a date of 9780 ± 110 BP (GSC-3573; McNeely, 1989).

GSC-3822. Caribou River (II)
uncorrected 7370 ± 80

The peat, sample HH-72-49-82-3 (248.4 g wet weight), enclosed in peat, was collected by N.R. Catto on July 10, 1982 from a river bluff, 55 km west of the confluence (66°15′N, 135°2′W), at an elevation of 401 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comments (N.R. Catto): The peat sample was obtained 25 cm beneath the upper contact of a peat unit 132 cm thick, which overlies 8.3 m of till and 8.6 m of gravel.

The date reflects the time of the re-establishment of open sclerophyll deciduous forest in the area, following fire events recorded in palynological assemblages in the peat unit. The area was covered by *Picea* and *Betula*, and a closed shrub cover dominated by Ericaceae. Small concentrations of *Alnus* type *crispa* pollen suggest that the region may have supported scattered *Alnus* shrubs at this time.

The base of the peat unit has been previously dated at 12 400 ± 120 BP (GSC-3691). The assemblages preserved indicate a transition between an upland environment adjacent to or beyond the treeline, and open sclerophyll forest, punctuated by fire events. Additional samples have been submitted for radiocarbon dating, to elucidate the chronology of the vegetative events.

GSC-3691. Caribou River (III)
uncorrected 12 400 ± 120

The peat, sample HH-72-49 82-14 (198.1 g dry weight), enclosed in peat, was collected by N.R. Catto on July 9, 1982 from Caribou River, 50 km southwest of the confluence (66°13′N, 135°11′W), at an elevation of 440 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comments (N.R. Catto): The peat sample was obtained from the base of a 132 cm thick peat layer, which overlies 8.3 m of till and 8.6 m of gravel. The sample site was situated at an elevation of approximately 440 m.

This basal date of 12 400 ± 120 BP reflects the first establishment of peat development at this site following deglaciation. The palynological assemblage is dominated by Cyperaceae, Gramineae, and *Betula* (shrub), with associated *Artemisia*, *Arnica*, and *Sagina*, and minor *Picea* (cf. *mariana*) identified by N.R. Catto. The assemblage suggests an upland environment adjacent to or beyond the treeline, with a climate somewhat colder than present. The terrain consisted of an unstable Cyperaceae wetland adjacent to Caribou River, which was prone to solifluction and other mass movement disturbances, and which was surrounded by sparsely vegetated slopes dominated by Gramineae and herbs with scattered shrubs. The *Picea* grains present were derived either from distal areas through aeolian transport, or from scattered small stands of stunted *Picea mariana*, possibly vegetatively reproducing in many instances.

GSC-3860. Fox Lake 11 100 ± 170
$\delta^{13}C$= -24.5‰

The fibrous organic silt sample BSP-1 (338-346 cm) was collected by R. Spear, L.C. Cwynar, and P. Carlyle on July 5, 1982 from approximately 11 km southeast of south end of Fox Lake, Yukon Territory (61°5′15″N, 135°16′10″W), at an elevation of 755.0 m; submitted by L.C. Cwynar.

The sample (80.3 g wet weight) was treated with hot acid (very slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4020 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.93.

The uncorrected age is 11 100 ± 170.

Corkery Creek Series

A series of moss and organic detritus samples from the left side of Corkery Creek, 3.3 km (direct distance) upstream from the highway crossing, Yukon Territory (63°51.2'N, 135°38.3'W), at an elevation of 870 m; submitted by O.L. Hughes.

GSC-4092. Corkery Creek (I) 7210 ± 130
$\delta^{13}C$= -26.8‰

The organic detritus, sample HH79-31 (1985) (6.58-6.67 m) (7.6 g dry weight), enclosed in silt, was collected by O.L. Hughes and C. Burn on June 25, 1985. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4110 minutes (one 3 day) in the 2 L counter with a mixing ratio of 3.16.

The uncorrected age is 7240 ± 130.

GSC-4020. Corkery Creek (II) 9000 ± 90
$\delta^{13}C$= -28.3‰

The moss sedge culms, sample HH79-31 (4.85-4.95 m) (12.0 g dry weight), enclosed in peat, were collected by O.L. Hughes and Y. Decoste on July 24, 1979. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9050 ± 90.

Comment (O.L. Hughes): The dated samples were collected from a perennially frozen bog using a gasoline powered permafrost coring kit. The bog occupies an area in the Corkery Creek valley immediately upstream from the Late Wisconsinan (McConnell) limit of the Cordilleran ice sheet. The limit is marked by a prominent moraine.

The samples are from two separate borings and represent in each case the deepest sample to yield enough organic material for dating.

GSC-4020 is minimum for retreat of the Cordilleran ice sheet from its maximum position and for drainage of a small glacial lake, which by inference occupied a part of Corkery Creek valley upstream of the glacial limit.

Comment (J.V. Matthews, Jr.): Sediments from the dated levels of both cores yielded plant and animal fossils. Among the plant fossils associated with GSC-4092 (unpublished GSC Plant Macrofossil Report No. 85-19) are seeds of *Alnus incana*, dwarf birch of the *Betula glandulosa* type, and a medium shrub species of *Betula*. The sample also contained abundant, well preseved needles of spruce (*Picea*). The spruce needles possess fungal hyphae which undoubtedly formed as the needles lay in a wet substrate after deposition. The birch seeds possessed a full complement of the small (and fragile) basal papillae that are seldom preserved on fossils. Also, one of the bracts of the *Betula glandulosa* type has an adhering samara. This is almost never seen in fossil deposits and shows, along with the excellent state of preservation of all of the other fossils, that the organics are autochthonous. Spruce, birch and alder were growing at the site when the sediments in the 6.58-6.67 m interval were deposited 7210 years ago. The arthropod fossils from the sample (unpublished GSC Fossil Arthropod Report No. 85-19) provide supporting evidence that the site was wet or submerged at the time of deposition or shortly after.

The sediments associated with GSC-4020 contained macrofossils of plants (unpublished GSC Plant Macrofossil Report No. 85-16) such as dwarf birch, various sedges (*Carex aquatilis*, *Carex diandra* type, *Eleocharis palustris-uniglumis* type, *Scirpus validus*), leaf fragments of the ericaceous plant *Oxycoccus microcarpus* and needles and seeds of spruce (*Picea*). The animal fossils include bryozoan statoblasts (*Cristatella mucedo*), a few fragments of beetles (Dytiscidae, *Olophrum*) head fragments of ants and cladoceran ephippia. The spruce fossils show that spruce was growing in the Mayo region by 9000 BP.

GSC-3723. Takhini 10 000 ± 90
$\delta^{13}C$= -28.4‰

The lake sediment, noncalcareous gyttja sample HOR-1 (435-440 cm) was collected by L.C. Cwynar, R. Spear, and P. Carlyle on July 3, 1982 from first pond west of bridge over Takhini River and south of Alcan Highway, Yukon Territory (60°51'N, 135°45'W), at an elevation of 675 m; submitted by L.C. Cwynar.

The sample (131.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4080 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 100 ± 90.

Stewart River Series

Wood samples from two sites on the Stewart River near the town of Mayo were dated. The first site, informally known as the 'Mayo Indian Village Section' is located at 63°36'N, 135°56'W on the north (right) bank of Stewart River about 2.5 km downstream from Mayo, Yukon Territory. Two samples were collected and submitted for dating by O.L. Hughes. The second site, informally designated the 'Mayo Section' is on south (left) bank of the Stewart River, 0.75 km downstream from Mayo, (63°35.01'N, 135°53.17'W), at an elevation of 488.9 m. The sample was collected by J.V. Matthews, Jr. and A. Telka on July 23, 1987; submitted by J.V. Matthews, Jr.

GSC-3931. Stewart River (I) >42 000
('Mayo Indian Village') $\delta^{13}C$= -26.4‰

The wood, sample HH60-34 (84) Stn 2 (11.6 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-33)), enclosed in silty sand, at an elevation of 490 m; was collected by O.L. Hughes and S. Morison on

July 18, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4320 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (O.L. Hughes): The wood was one of several pieces collected from a complex of sand, gravel, and diamicton that underlies Mayo Till at the site, known as Mayo Indian Village Section (Hughes et al., 1987). Another wood sample from the same complex and a wood sample from the base of Mayo Till have also yielded "greater than" dates (GSC-331; Dyck et al., 1966 and I(GSC)-180; Trautman and Walton, 1962, respectively). However, seeds of *Corispermum* from organic silt and sand beneath the complex yielded an accelerator date of 29 640 ± 260 BP (TO-292), indicating that the complex and the overlying Mayo Till were deposited sometime after that date. This and the other wood samples of "greater than" age are presumed to have been recycled from older deposits (Hughes et al., 1987).

GSC-4436 HP. Stewart River (II) >51 000
('Mayo Indian Village')

The wood, sample HH60-34 (1985)-4 (47.3 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 87-19)), enclosed in sand, at an elevation of 430 m, was collected by O.L. Hughes on June 26, 1985 and was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 5310 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (O.L. Hughes): The wood was collected 1.75 m below the base of till assigned to McConnell Glaciation of the Cordilleran Ice Sheet. The enclosing sand was part of a glaciofluvial sand and gravel unit interpreted to be advance outwash of that glaciation. Three previous wood samples from below till of the same section have yielded "greater than" dates: I(GSC)-180 (>35 000 BP; Trautman and Walton, 1962); GSC-331 (>46 580 BP; Dyck et al., 1966); GSC-3931 (>42 000 BP). However, seeds of *Corispermum hyssopifolium* from lower in the section than any of the wood samples have yielded an AMS age of 29 640 ± 260 BP (TO-292). The wood samples are clearly reworked, evidently from unknown wood-bearing sediments that are beyond the range of radiocarbon dating. The *Corispermum* seeds occur in fluvial sediments and are transported, but are likely of local origin and contemporaneous with the enclosing sediments. The date of 29 640 ± 260 BP is maximum for deposition of the overlying till during McConnell Glaciation of the Cordilleran Ice Sheet.

GSC-4554. Stewart River (III)
('Mayo Section')
uncorrected 38 100 ± 1330

The wood sample MRA-7-23-87-4, a stump of *Salix*, identified by H. Jetté (unpublished GSC Wood Report No. 88-4), was in growth position, approximately 2 m above river level in July 1987, and enclosed in a gravel unit containing lenses of silt and peat at the base of a 15 m section containing several gravel units capped by till of McConnell age. The sample (13.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2510 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (J.V. Matthews, Jr.): The stump was carefully excavated and found to be in growth position so the date provides a good estimate of the age of the lowest part of this section. It is likely that the unit containing the stump is correlative with the lowest part of the 'Mayo Indian Village' section below the level dated by TO-292 at 29.6 ka (see GSC-3931 and -4436 HP, and Matthews et al., 1990). Detrital organics 5 m above the stump yield a macroflora very similar to that associated with TO-292 and like the TO-292 flora also suggest tundra conditions. Autochthonous peat horizons at about the same level as the stump at other parts of the section contain spruce needles, showing that spruce was probably growing in the Mayo region at 38 ka.

Two additional gas preparations were made from the wood sample used for GSC-4554 and counted in both the 2 L and 5 L. Preparation number 2 of the wood sample MRA-7-23-87-4 (10.2 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The treated sample (7.1 g) yielded 7.33 L of CO_2 gas.

GSC-4554 2 (5 L) 36 000 ± 1260
$\delta^{13}C$= -26.3‰

The age estimate is based on one count for 4200 minutes in the 5 L counter with a mixing ratio of 1.00. The count rate for the sample, and monthly backgrounds and standards were 0.320 ± 0.050, 2.122 ± 0.043, 28.206 ± 0.127 cpm, respectively.

The uncorrected age is 36 000 ± 1260.

GSC-4554 2 (2 L) 35 200 ± 920
$\delta^{13}C$= -26.3‰

The age estimate is based on four counts for 5300 minutes in the 2 L counter with a mixing ratio of 1.00. The count rate for the sample, and monthly backgrounds and standards were 0.223 ± 0.025 1.052 ± 0.017 17.959 ± 0.159 cpm, respectively.

The uncorrected age is 35 200 ± 920.

The third preparation of wood sample MRA-7-23-87-4 (10.3 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The treated sample (6.3 g) yielded 6.36 L of CO_2 gas.

GSC-4554 3 (5 L) 36 300 ± 1330
$\delta^{13}C$= -26.1‰

The age estimate is based on one count for 3750 minutes in the 5 L counter with a mixing ratio of 1.00. The count rate for the sample, and monthly backgrounds and standards were 0.307 ± 0.050, 2.122 ± 0.043, 28.206 ± 0.127 cpm, respectively.

The uncorrected age is 36 300 ± 1330.

GSC-4554 3 (2 L) 33 700 ± 1020
$\delta^{13}C$= -26.1‰

The age estimate is based on one count for 4200 minutes in the 2 L counter with a mixing ratio of 1.00. The count rate for the sample, and monthly backgrounds and standards were 0.275 ± 0.034, 1.059 ± 0.029, 18.169 ± 0.099 cpm, respectively.

The uncorrected age is 33 700 ± 1020.

Comment (R. McNeely): The large sample size and apparent age of the material provided an excellent opportunity to check the reproducibility of the GSC counters close to our operational background of about 39-40 ka. Subsequent to the original preparation for GSC-4554, two additional, separate gas preparations were made and counted in both the 2 L and 5 L counters. In both cases the agreement between the counters on each gas preparation was acceptable, but the 2 L counts were consistently younger. All three 5 L dates are in good agreement, as are the two 2 L dates, but the range of the five determinations is beyond statistical limits and suggests that our estimate of error in this age range is too small (cf. Scott et al., 1990). Thus the age of this material should probably be considered to be 36.0 ± 2.5 ka.

Klondike Highway Series

A series of lake sediment and moss samples from just off the west side of Klondike Highway, 37.5 km south of Stewart Crossing, Yukon Territory (64°4′N, 136°26′W), at an elevation of 730 m, were collected by L.C. Cwynar, R. Spear, and P. Carlyle on July 8, 1982; submitted by L.C. Cwynar.

GSC-3829. Klondike Highway (I) 1260 ± 100
$\delta^{13}C$= -29.2‰

The lake sediment, pond mud sample Bug-1 (15-20 cm) (77.4 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2180 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.88.

The uncorrected age is 1320 ± 100.

GSC-3839. Klondike Highway (II) 5630 ± 70
$\delta^{13}C$= -28.1‰

The moss peat (sample Bug-1; 110-115 cm; 85.1 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5680 ± 70.

Eagle River Series

A series of organic samples from the east bank of Eagle River, 12 km east and 15 km south of the southern tip of Whitefish Lake, Bell Basin, Yukon Territory (67°5.8′N, 137°3.2′W), at an elevation of approximately 320 m, were collected by J.V. Matthews, Jr. on July 10, 1980; submitted by J.V. Matthews, Jr.

GSC-3942. Eagle River (I)
uncorrected 1400 ± 80

The sieved organics from a moss mat (sample MRA-7-10-80-4, 19.5 g dry weight), were treated with hot acid (noncalcareous) and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-3984. Eagle River (II)
uncorrected 31 700 ± 560

The organic detritus (sample MRA-7-10-80-3, 14.0 g dry weight), was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.0.

Comment (J.V. Matthews, Jr.): The dated organics for GSC-3942 consisted entirely of well preserved mosses in a fibrous mat. The mat appeared to be in the same unit of Late Wisconsinan sand and silt containing detrital organics dated by GSC-3984 at 31 700 ± 560 and was approximately 8 m below an autochthonous peat, which caps the section. The base of this peat is dated at 9970 ± 160, (see discussion of GSC-3133 in Blake, 1984). Thus the GSC-3984 date is clearly at odds with other findings. When the dated sample was first collected, the author believed that the moss mat represented one of the rare instances in which a mass of autochthonous organics, such as a turf mat, falls into a river and then is buried *en mass* in alluvium. The young date on this sample shows instead that the moss mat is a detached block from near the *present* surface. It probably fell down a crack in the section, which was then filled and frozen.

GSC-3976. Eagle Crossing >36 000
$\delta^{13}C$= -24.6‰

The wood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-44)) was enclosed in sand. Sample RR-80-10 (Ua-819) was collected by N.W. Rutter on July 8, 1980 from a river bluff on the east bank of Eagle River, 70 km north-northwest of Eagle Crossing, Yukon Territory (67°4′N, 137°6′W), at an elevation of approximately 320 m; submitted by N.W. Rutter.

The sample (6.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 7200 minutes (one 5 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (N.W. Rutter): The sample was obtained from granite-bearing sand, 17.5 m above river level. The sample layer was underlain by varved clay and finely crossbedded sand and overlain by 29 m of lacustrine deposits.

GSC-4195. Lake Dezadeash modern
$\delta^{13}C = -28.9‰$

The wood (*Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-2)) was enclosed in clay, silt, and organic material. Sample 85-DL-38 cm was collected by D. Lacasse in July, 1985 from about 3500 m west of Haines Road and Lake Dezadeash, about 50 km south-southwest of Haines Junction, Yukon Territory (60°29′30″N, 137°7′50″W), at an elevation of approximately 1220 m; submitted by P.G. Johnson and D. Lacasse.

The sample (11.5 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1340 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (P.G. Johnson and D. Lacasse): The sample of *Salix* sp. was located at the boundary between the till and the soil formation on the third (of seven) lobes of a glacier ice cored rock glacier in Dalton Range, southwest Yukon. Each lobe of the rock glacier is hypothesized to represent a glacier advance. The modern age of the sample indicates a modern age for the rock glacier lobe and indicates there have been recent advances (Little Ice Age) of this glacier.

GSC-4244. Stewart River >38 000

The wood in small fragments (*Salix*?; identified by R.J. Mott (unpublished GSC Wood Report No. 86-21)) was enclosed in silt. Sample HH65-24-5-1 was collected by O.L. Hughes on June 28, 1965 from the left bank Stewart River at Stirling Bend, 13 km upstream by river from the mouth of McQuesten River, Yukon Territory (63°30.3′N, 137°19.7′W), at an elevation of 455 m; submitted by O.L. Hughes.

The sample (9.8 g dry weight) was treated with cold base, hot acid, and distilled water rinses. The age estimate is based on one count for 5580 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.00.

GSC-3753. Walking River 8880 ± 80
$\delta^{13}C = -26.5‰$

The wood (*Populus*; identified by R.J. Mott (unpublished GSC Wood Report 84-3)), enclosed in fluviatile stratified sands and gravels, (Sample site: VH83-001, No. 830019) was collected by J-S. Vincent and V.N. Rampton on July 24, 1983 from river bluff on the right bank of Walking River, 5 km from its mouth, 2.5 km west of Bar at Shingle Point DEW Line site, on the coastal plain, Yukon Territory (68°54.3′N, 137°20.5′W), at an elevation of 50 m; submitted by J-S. Vincent.

The sample (12.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one 1 day and one 4 day count for 6920 minutes in the 5 L counter with a mixing ratio of 1.0.

The uncorrected age is 8900 ± 80.

GSC-3769. Gravel Lake
uncorrected 9850 ± 80

The organic detritus was enclosed in silt. Sample HH65-27, 3.6-3.75 m core was collected by O.L. Hughes on July 2, 1965 from northeast side of Klondike Highway, 6.4 km southeast of Gravel Lake, Yukon Territory (63°47.8′N, 137°51′W), at an elevation of 617 m; submitted by O.L. Hughes.

The sample (30.5 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4020 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (O.L. Hughes): The sample was collected from the base of a perennially frozen peat bog using a gasoline-powered permafrost coring kit. The coring site is in a broad part of Tintina Trench that was last glaciated in pre-Reid (probably pre-Illinoian) time. The Holocene age indicates that at least some of the peat bogs of the area were not initiated until Holocene time, despite the relatively great age of the surface.

GSC-4345. King Point modern
$\delta^{13}C = -28.6‰$

The wood roots (*Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-37)) were enclosed in a stony clay diamicton. Sample DHA 86-013 was collected by S.R. Dallimore on July 8, 1986 from flow deposit of retrogressive thaw flow slide approximately 100 m west of King Point Lagoon, King Point, Yukon Territory (69°7′N, 138°0′W), at an elevation of approximately 16 m; submitted by S.R. Dallimore.

The sample (8.9 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2170 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 60 ± 50.

Comments (S.R. Dallimore): The date gives a maximum age for the buried snowbank and an estimate of the time of initiation of the retrogressive thaw flow slide.

GSC-3752. Talbot Creek 3840 ± 60
$\delta^{13}C = -26.4‰$

The organics were enclosed in clay and coarse alaskite sand. Sample Bonanza 23 was collected by P.G. Johnson and S. Chapman on June 23, 1983 from the head of Talbot Creek,

35 km east of Kluane Lake, Yukon Territory (61°28′N, 138°8′W), at an elevation of 1600 m; submitted by P.G. Johnson.

The sample (31.0 g dry weight) was treated with cold base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2290 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3860 ± 60.

Monkshood Series

A series of lake sediment samples from North Fork Pass, on the west side of Dempster Highway, Yukon Territory (64°34′N, 138°15′W), at an elevation of 1280 m, were collected by L.C. Cwynar, R. Spear, M. Lacy, and J. Wood on July 11, 1983; submitted by L.C. Cwynar.

GSC-3899. Monkshood (I) 2440 ± 90
$\delta^{13}C$= -30.7‰

The lake sediment, silty gyttja (sample Monkshood; 60-65 cm; 62.8 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2380 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.67.

The uncorrected age is 2530 ± 90.

GSC-3893. Monkshood (II) 3930 ± 110
$\delta^{13}C$= -28.3‰

The lake sediment, silty gyttja (sample Monkshood; 95-100 cm; 76.0 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2290 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.42.

The uncorrected age is 3980 ± 110.

GSC-3890. Monkshood (III) 4690 ± 80
$\delta^{13}C$= -30.3‰

The lake sediment, silty gyttja (sample Monkshood; 125-130 cm; 91.5 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.11.

The uncorrected age is 4780 ± 80.

GSC-3879. Monkshood (IV) 6590 ± 90
$\delta^{13}C$= -29.4‰

The lake sediment, silty gyttja (sample Monkshood; 155-160 cm; 74.9 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.13.

The uncorrected age is 6660 ± 90.

GSC-3881. Monkshood (V) 7830 ± 90
$\delta^{13}C$= -29.7‰

The lake sediment, silty gyttja (sample Monkshood; 175-180 cm; 95.8 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses, base treatment was omitted. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7910 ± 90.

GSC-3866. Monkshood (VI) 8310 ± 100
$\delta^{13}C$= -29.6‰

The organic silt with abundant moss (sample Monkshood; 190-195 cm; 83.4 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8380 ± 100.

GSC-3847. Monkshood (VII) 9440 ± 100
$\delta^{13}C$= -25.9‰

The lake sediment (sample Monkshood-2; 225-235 cm; 134.7 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9450 ± 100.

GSC-3842. North Fork Pass 7850 ± 100
$\delta^{13}C$= -28.7‰

The lake sediment (sample Veronica's Pool-1; 280-292 cm) was collected by L.C. Cwynar, R. Spear, M. Lacy, and J. Wood on July 12, 1983 from North Fork Pass, west side of Dempster Highway, Yukon Territory (64°34′N, 138°15′W), at an elevation of 1190 m; submitted by L.C. Cwynar.

The sample (156.6 g wet weight) was treated with hot acid (noncalcareous) and distilled water; base treatment was omitted. The age estimate is based on two counts for 2620 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7900 ± 100.

Dempster Highway Series

A series of lake sediment samples from approximately 12 km north-northeast of Chapman Lake, on the east side of Dempster Highway, Yukon Territory (64°57′N, 138°15′W), at an elevation of 915.0 m, were collected by R. Spear, L.C. Cwynar, and P. Carlyle on July 11, 1982; submitted by L.C. Cwynar.

GSC-3805. Dempster Highway (I) 1240 ± 70
$\delta^{13}C$= -30.0‰

The lake sediment, noncalcareous gyttja (sample GDP-4; 25-30 cm; 70.4 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.23.

The uncorrected age is 1330 ± 70.

GSC-3790. Dempster Highway (II) 2600 ± 70
$\delta^{13}C$= -32.0‰

The lake sediment, gyttja (sample GDP-3; 55-60 cm; 79.7 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2180 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 2710 ± 70.

GSC-3876. Dempster Highway (III) 4230 ± 70
$\delta^{13}C$= -28.3‰

The lake sediment, silty gyttja (sample GDP-6; 71-75 cm; 73.2 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2420 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.05.

The uncorrected age is 4280 ± 70.

GSC-3779. Dempster Highway (IV) 6160 ± 80
$\delta^{13}C$= -30.8‰

The lake sediment, gyttja (sample GDP-2; 86-89 cm; 51.1 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6250 ± 80.

GSC-3870. Dempster Highway (V) 8130 ± 100
$\delta^{13}C$= -28.5‰

The organic material, moss and twigs (sample GDP-5; 99-102 cm; 45.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2470 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8190 ± 100.

GSC-3770. Dempster Highway (VI) 9520 ± 110
$\delta^{13}C$= -27.4‰

The lake sediment, organic silt (sample GDP-1; 110-113 cm; 53.0 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9550 ± 110.

GSC-3868. Dempster Highway (VII) 8380 ± 90
$\delta^{13}C$= -28.8‰

The organic silt with moss (sample GDP-7; 121-126 cm; 58.8 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8440 ± 90.

Chapman Series

A series of lake sediment samples from approximately 3 km northwest of Chapman Lake, just off west side of highway, Yukon Territory (64°52′N, 138°18′W), at an elevation of 945.0 m, were collected by L.C. Cwynar, R. Spear and P. Carlyle on July 12, 1982; submitted by L.C. Cwynar.

GSC-3758. Chapman (I) 4850 ± 80
$\delta^{13}C$= -31.0‰

The lake sediment, gyttja (sample MP-3; 170-175 cm; 84.8 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2160 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4950 ± 80.

GSC-3756. Chapman (II) 9890 ± 110
$\delta^{13}C$= -27.0‰

The lake sediment, organic silt (sample MP-2; 225-230 cm; 118.8 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9920 ± 110.

GSC-3748. Chapman (III) 10 900 ± 90
$\delta^{13}C$= -27.1‰

The mottled organic noncalcareous silt (sample MP-1; 400-405 cm; 126.4 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 900 ± 90.

North Fork Pass/Dempster Highway Series

A series of lake sediment samples from north of North Fork Pass and 1 km west of Dempster Highway, Yukon Territory (64°38'N, 138°24'W), at an elevation of 1160 m, were collected by L.C. Cwynar, A. Christmas, R. Spear, L. Leung, M. Lacy, and P. Huotari on August 7, 1984; submitted by L.C. Cwynar.

GSC-4081. North Fork/Dempster (I) 6120 ± 100
$\delta^{13}C$= -33.2‰

The lake sediment, mud (sample Honeymoon-1; 275-280 cm; 91.3 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6250 ± 100.

GSC-4058. North Fork/Dempster (II) 9840 ± 100
$\delta^{13}C$= -30.9‰

The lake sediment, mud (sample Honeymoon-2; 385-390 cm; 102.0 g wet weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9940 ± 100.

GSC-4068. North Fork/Dempster (III) 8770 ± 90
$\delta^{13}C$= -32.5‰

The lake sediment, mud (sample Honeymoon-2; 368-373 cm; 74.8 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 5560 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8890 ± 90.

GSC-4344. Stokes Point DEW Line site 930 ± 70
$\delta^{13}C$= -27.9‰

The wood, roots and twigs (*Salix planifolia, S. pulchra*; identified by G.W. Argus (NMNS)) sample DHA 86-30 was collected by S.R. Dallimore on July 12, 1986 from the coast approximately 5 km southeast of Stokes Point DEW Line site, Stokes Point, Yukon Territory (69°17'N, 138°37'W), at an elevation of 10 m; submitted by S.R. Dallimore.

The sample (6.9 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2370 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 980 ± 70.

Comments (S.R. Dallimore): The date gives a maximum age for the buried snowbank and an estimate of the time of initiation of the retrogressive thaw flow slide.

GSC-3747. Stokes Point 7510 ± 100
$\delta^{13}C$= -29.6‰

The wood (*Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-45)) was enclosed in organic silt. Sample MRA-7-28-83-6 was collected by J.V. Matthews, Jr. on July 28, 1983 from coastal scarp opposite west end of a large lagoon west of Stokes Point, Yukon Territory (69°22'N, 138°48.4'W), at an elevation of 0-2 m; submitted by J.V. Matthews, Jr.

The sample (4.6 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 6920 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.32.

The uncorrected age is 7590 ± 100.

Comment (J.V. Matthews, Jr.): The peat from which the dated wood comes (sample MRA 7-28-83-5) is autochthonous and contained an abundance of macrofossils of plants and a few of insects. *Carex* achenes are abundant. Other plant fossils represent sedges like *Scirpus*, the ericads *Arctostaphylos* and *Empetrum*, as well as *Ranunculus trichophyllus, Potentilla palustris, Potamogeton* and *Hippuris*. The peat probably formed in a sedge-dominated depression surrounded by mesic tundra containing heaths.

Sixtymile River Series

A series of wood and peat samples from the north side of Sixtymile River below mouth of Miller Creek, at the Brisebois Bros. operation, Yukon Territory (63°59.7'N, 140°47'W), at an elevation of 730 m, were collected by O.L. Hughes on July 19, 1984; submitted by O.L. Hughes.

GSC-4032. Sixtymile River (I) >40 000

The sedge peat (sample HH84-13; 14.4 m; 42.5 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 5580 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-3934. Sixtymile River (II) >42 000
$\delta^{13}C$= -24.5‰

The wood (sample HH84-13; 12.5 m; 11.4 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-34)), enclosed in organic silt, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (O.L. Hughes): At the site, a placer gold mining pit operated by Brisebois Bros., about 14 m of gravel overlies bedrock and is overlain by 7 m of peat and organic silt. The gravel is part of a fan complex derived from Miller Creek and graded to a high terrace along Sixtymile River (Hughes et al., 1986).

GSC-3934 was collected from an organic silt lens 1.5 m below the top of the gravel; GSC-4032 was collected from dense felted sedge peat 0.4 m above the gravel. The dates indicate that aggradation of the fan was completed more than 40 ka (Hughes et al., 1986, p. 52).

Northwest Territories (mainland)

Athenia Lake Series

A series of lake sediment samples from 4 km west of Athenia Lake, District of Mackenzie, Northwest Territories (63°38'N, 111°40'W), at an elevation of 424 m, were collected by G.M. MacDonald and K.D. Bennett on April 24, 1985; submitted by G.M. MacDonald.

GSC-4219. Athenia Lake (I) 2240 ± 100
$\delta^{13}C$= -29.0‰

The lake sediment, gyttja (sample S22-E; 40-36 cm; 47.4 g wet weight), enclosed in gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2180 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.35.

The uncorrected age is 2300 ± 100.

GSC-4198. Athenia Lake (II) 3150 ± 100
$\delta^{13}C$= -28.0‰

The lake sediment, gyttja (sample S22-D; 80-74 cm; 51.6 g wet weight), enclosed in gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.07.

The uncorrected age is 3200 ± 100.

GSC-4188. Athenia Lake (III) 4130 ± 120
$\delta^{13}C$= -30.2‰

The lake sediment, gyttja (sample S22-C; 120-114 cm; 47.0 g wet weight), enclosed in gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2510 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.27.

The uncorrected age is 4220 ± 120.

GSC-4145. Athenia Lake (IV) 7030 ± 130
$\delta^{13}C$= -28.7‰

The lake sediment, gyttja (sample S22-B; 180-175 cm; 52.4 g wet weight), enclosed in gyttja, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.85.

The uncorrected age is 7090 ± 130.

GSC-4140. Athenia Lake (V) 7710 ± 230
$\delta^{13}C$= -25.2‰

The organic lake sediment (sample S22-A; 193-197 cm; 47.3 g wet weight), enclosed in organic silt, was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 5090 minutes (two 2 day) in the 2 L counter with a mixing ratio of 3.73.

The uncorrected age is 7720 ± 230.

Slave River Series

A series of wood samples were collected from Slave River, downriver from Fort Smith, District of Mackenzie, Northwest Territories; submitted by D.G. Smith.

GSC-4216. Slave River (I) 160 ± 60
$\delta^{13}C$= -21.7‰

The wood (sample DGS-85-1; 5.6 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 85-67)), enclosed in sand, was collected by D.G. Smith on June 6, 1985 from right cutbank of Slave River, 41.8 km downriver from Fort Smith (60°15'N, 112°18'W), at an elevation of 167 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2250 minutes (two 1 day), in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 110 ± 60.

GSC-4197. Slave River (II) 3340 ± 60
$\delta^{13}C$= -26.6‰

The wood (sample DGS-85-12; 11.3 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-5)), enclosed in sand, was collected by S. Vanderburgh on August 1, 1985 from Slave River, 233.0 km downriver from Fort Smith (61°5'N, 113°10'W), at an elevation of 150 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3370 ± 60.

Comment (D.G. Smith): A sample from the same piece of wood was sent to Teledyne Isotopes (I-14579) and dated at 3600 ± 100 BP, which corresponds well with GSC-4197 (3370 ± 60 BP).

GSC-4118. Slave River (III) 5860 ± 70
$\delta^{13}C$= -26.7‰

The wood (sample DGS-85-3; 12.1 g dry weight; *Populus*; identified by H. Jetté (unpublished GSC Wood Report No. 85-68)), enclosed in sand, was collected by D.G. Smith on June 8, 1985 from 'Mile 397' on Tug Boat navigation charts, in right cutbank of Slave River, 119 km downriver from Fort Smith (60°33.25'N, 112°39'W), at an elevation of 168 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2320 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5880 ± 70.

GSC-4186. Slave River (IV) 6380 ± 70
$\delta^{13}C$= -24.9‰

The wood (sample DGS-85-2; 11.3 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 85-72)), enclosed in sand, was collected by D.G. Smith on June 7, 1985 from Grand Detour Location, in right cutbank (west bank) of Slave River, 73.2 km downriver from Fort Smith (60°23.5'N, 112°39'W), at an elevation of 169 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6380 ± 70.

GSC-4121. Slave River (V) 6960 ± 70
$\delta^{13}C$= -27.5‰

The wood (sample DGS-85-4; 13.0 g dry weight; *Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 85-70)), enclosed in sand, was collected by D.G. Smith on June 15, 1985 from 'Mile 354.5' on Tug Boat navigation charts, in right cutbank of Slave River, 50.7 km downriver from Fort Smith (60°18.6'N, 112°24'W), at an elevation of 167 m. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7000 ± 70.

Comment (D.G. Smith): Samples GSC-4106, -4118, -4121, -4197, and -4216 are all part of a sequence of 11 dates, which have been used to date the progradation rate of the Early Holocene Slave River Delta (Vanderburgh and Smith, 1988). The GSC dates correspond well with 7 Teledyne Isotope dates, all of which show a trend of decreasing age of wood associated with deltaic deposits extending from Fort Smith to Great Slave Lake. A map showing the trend is presented in Vanderburgh and Smith (1988).

GSC-3825. Bloody Fall 3810 ± 60
$\delta^{13}C$= -27.8‰

The wood twigs (*Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 81-30)) were enclosed in sand. Sample DS 81-19 was collected by D.A. St-Onge on July 23, 1981 from 1.8 km north of Bloody Fall, left bank of Coppermine River, District of Mackenzie, Northwest Territories (67°45'41"N, 115°20'52"W), at an elevation of 70 m; submitted by D.A. St-Onge.

The sample (10.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2180 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3860 ± 60.

Comment (D.A. St-Onge): Sample is from the base of a 3 m accumulation of peaty material partly filling a paleochannel cut into a deltaic complex. The delta at 70 m was constructed by Coppermine River during marine regression. The date at 3.86 ka indicates that peat accumulation was a relatively late feature in the paleochannel (cf. GSC-3327, Blake, 1983).

GSC-3705. Exmouth Lake
uncorrected 6870 ± 90

The peat (sample SV 83-12) was collected by D.A. St-Onge on July 4, 1983 from the bottom of a bedrock valley at the northeast end of Exmouth Lake, District of Mackenzie, Northwest Territories (65°7'N, 115°56'W), at an elevation of 364 m; submitted by D.A. St-Onge.

The sample (68.9 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.0.

Comment (D.A. St-Onge): The date indicates when peat began to accumulate in poorly drained areas in the Exmouth Lake area. Pollen analysis by Prof. M. Geurts, Département de géographie, Université d'Ottawa should clarify the paleoclimatic significance of the date.

Quicksand Creek Series

A series of peat samples from a south facing section along the south branch of Quicksand Creek, District of Mackenzie, Northwest Territories (66°49′30″N, 116°21′W), at an elevation of 325 m, were collected by D.A. St-Onge on July 17, 1987; submitted by D.A. St-Onge.

GSC-4486. Quicksand Creek (I) 870 ± 90
uncorrected

The peat (sample SV 87-2; top of peat; 12.5 g dry weight), underlain by a glaciomarine complex and overlain by aeolian sand, was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (D.A. St-Onge): This date marks the end of peat accumulation in a channel cut in a deltaic complex formed in Glacial Lake Coppermine. Organic-rich sediments began filling the channel 8400 ± 80 BP (GSC-2959, Lowdon and Blake, 1980). A capping of peat which started forming 7180 ± 100 BP (GSC-4495) was covered by aeolian sand after 870 ± 90 BP as indicated by this date. This differs from previous interpretations based on a date obtained on a block of peat 3210 ± 60 BP (GSC-2998, Lowdon and Blake, 1980).

GSC-4495. Quicksand Creek (II) 7180 ± 100
uncorrected

The basal peat (sample SV 87-1; 25.0 g dry weight), underlain by a glaciomarine complex and overlain by peat, was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.12.

Comment (D.A. St-Onge): This date, based on a thin (less than 0.5 cm) layer at the base of the peat, corrects GSC-2998 (Lowdon and Blake, 1980), which was done on a block of peat. The new date has several important implications: 1) peat accumulation started before 7.0 ka; 2) the channel fill, which started 8400 ± 80 BP (GSC-2959, Lowdon and Blake, 1980), continued without marked interruptions until 870 ± 90 BP (GSC-4486), and 3) because the peat that accumulated for 6.3 ka is now compressed into a thickness of less than 1 m, pollen studies would have to be based on closely spaced samples.

Clifton Point Series

A series of marine shell samples were collected in the Clifton Point region, District of Mackenzie, Northwest Territories; submitted by D.A. St-Onge.

GSC-4425. Clifton Point (I) 8890 ± 110
$\delta^{13}C = +0.4‰$

The marine shells (sample SV (A) 86-11; 13.6 g dry weight; *Clinocardium ciliatum*; identified by TSD staff), enclosed in sand, were collected by R. Avery on July 17, 1986 from 3 km south-southwest of Clifton Point (69°11′32″N, 118°38′49″W), at an elevation of 12-14 m. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.69.

The uncorrected age is 8890 ± 110.

Comment (D.A. St-Onge): The paired shells were collected between 12 and 14 m a.s.l. in an area where marine limit is approximately 100 m a.s.l. The date indicates a relatively early infilling with sand of the bedrock basin south of Clifton Point. The date also suggests that the pelecypods were living in water probably more than 50 m deep.

GSC-4402. Clifton Point (II) 10 300 ± 100
$\delta^{13}C = +0.8‰$

The marine shells (sample SV (M) 86-20; 27.0 g dry weight; *Hiatella arctica*; identified by TSD staff), enclosed in sandy silt, were collected by I. McMartin on July 14, 1986 from 9 km south-southeast of Clifton Point (69°8′5″N, 118°35′45″W), at an elevation of 47 m. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 100.

Comment (D.A. St-Onge): Marine limit in this area is approximately 100 m (between 91.5 m and 107 m). The age, only 400 years younger than the oldest date to 10.7 ka (GSC-4318 and -4390) obtained in this region, suggests that these pelecypods were living in relatively deep water (see also GSC-4424).

GSC-4424. Clifton Point (III) 10 400 ± 100
$\delta^{13}C = +1.3‰$

The marine shells (sample SV 86-5; 41.8 g dry weight; *Hiatella arctica*; identified by TSD staff), enclosed in silty clay, were collected by D.A. St-Onge on July 23, 1986 from 6 km southeast of Clifton Point (69°9′32″N, 118°38′17″W), at an elevation of 25 m. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2390 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 100.

Comment (D.A. St-Onge): Marine limit in this area is approximately 100 m (between 91.5 and 107 m). The age, only 400 years younger than the oldest date to 10.7 ka

(GSC-4318 and -4390) obtained in this region, suggests that these pelecypods were living in relatively deep water (see also GSC-4402).

GSC-4390. Clifton Point (IV) 10 700 ± 100
$\delta^{13}C = +1.0‰$

The marine shells (sample SV 86-7; 29.4 g dry weight; *Hiatella arctica*; identified by TSD staff), enclosed in medium to coarse sand, were collected by D.A. St-Onge on July 3, 1986, from 8.5 km south-southwest of Clifton Point, (69°8′23″N, 118°41′34″W), at an elevation of 61 m. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 100.

Comment (D.A. St-Onge): The date is identical to GSC-4318 at marine limit further east. This sample, collected at 61 m, is approximately 30 m below marine limit in the area of Clifton Point. No shells were found between 61 and 90 m a.s.l.

GSC-4368. Bluenose Lake
uncorrected 4760 ± 90

The peat was enclosed in silty sand. Sample SV 86-27(A) was collected by D.A. St-Onge on July 18, 1986 from east of a large lake at northeast end of Bluenose Lake, District of Mackenzie, Northwest Territories (68°38′4″N, 119°23′12″W), at an elevation of 600 m; submitted by D.A. St-Onge.

The sample (79.1 g dry weight) was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 2240 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (D.A. St-Onge): The date indicates the time when peat began to accumulate in a kettle (or thermokarst pond?). It does not provide information on the age of the enclosing glaciolacustrine deltaic sand, the minimum age of which is greater than 11.0 ka. The postclimatic optimum age of the peat may have some interesting paleoclimatic implications for that region. Pollen and other analyses should shed light on this aspect of the problem.

GSC-4374. Tinney Point 570 ± 60
$\delta^{13}C = -24.5‰$

The wood (*Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-39)) was obtained from the surface of a gravel beach. Sample SV(K) 86-56 was collected by D. Kerr on July 25, 1986 from 9 km west of Tinney Point, District of Mackenzie, Northwest Territories (69°20′7″N, 119°58′52″W), at an elevation of 45 m; submitted by D.A. St-Onge.

The sample (8.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 1020 minutes (one 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 570 ± 60.

Comment (D.A. St-Onge and D. Kerr): Because of its comparatively young age, the piece of wood (*Picea*), collected from a raised gravel beach (45 m a.s.l.) near marine limit, is not associated with a sea level stand at this elevation. Marine shells from the general vicinity have yielded maximum ages of 10 700 ± 100 BP (GSC-4318). As spruce is not found growing in this area today, the reason for the presence of the piece of wood at that elevation is a matter of speculation only.

Buchanan River Series

A series of marine shell samples were collected by D. Kerr in the Buchanan River region, District of Mackenzie, Northwest Territories; submitted by D.A. St-Onge.

GSC-4347. Buchanan River (I) 9810 ± 120
$\delta^{13}C = +1.7‰$

The marine shells (sample SV (K) 86-49; 19.5 g dry weight; *Hiatella arctica*; identified by TSD staff), enclosed in sandy clay mud boil, were collected on July 23, 1986 from 10 km west of the mouth of Buchanan River (69°24′39″N, 120°17′21″W), at an elevation of 10 m. The sample was treated with an acid leach to remove the outer 10% of the shells. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.19.

The uncorrected age is 9780 ± 120.

Comment (D.A. St-Onge): Shells from the same area collected at marine limit (30 m a.s.l.) yielded an age of 10 700 ± 100 BP (GSC-4318), an age less than 1.0 ka younger for a sample 20 m lower and only 10 m above present sea level. This indicates either a very rapid initial rebound or that the molluscs were living in water of unknown depth; thus the date would not indicate the age of the marine stand at that time.

GSC-4339. Buchanan River (II) 10 600 ± 120
$\delta^{13}C = +1.1‰$

The marine shells (sample SV (K) 86-10; 42.3 g dry weight; *Hiatella arctica*; identified by TSD staff), enclosed in diamicton, were collected on July 10, 1986 from 7 km west of the mouth of Buchanan River (69°23′18″N, 120°13′29″W), at an elevation of 31 m. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2250 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 600 ± 120.

Comment (D.A. St-Onge): The relatively young date, which is consistent with others indicates that deglaciation occurred shortly before 10.7 ka (GSC-4318 and -4390). The diamicton from which fragments were collected is certainly not a till deposited by glacier ice having overridden fossiliferous marine sediments, rather, the diamicton is more probably a debris flow that redeposited glaciogenic and marine sediments. This date emphasized the great care that must be taken when interpreting the origin of "bedded", "stratified", or "banded" tills.

GSC-4318. Buchanan River (III) 10 700 ± 100
$\delta^{13}C$= +0.7‰

The marine shells (sample SV (K) 86-46; 42.0 g dry weight; *Hiatella arctica*; identified by TSD staff), enclosed in sandy clay, were collected on July 28, 1986 from 12 km west of the mouth of Buchanan River (69°24′30″N, 120°18′45″W), at an elevation of 30 m. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4210 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 700 ± 100.

Comment (D.A. St-Onge): The date is younger than was anticipated given other dates further east: 10 530 ± 260 BP (I(GSC)-25, Walton et al., 1961) along Harding River south of Cape Young; 10 215 ± 220 BP (I(GSC)-17, Walton et al., 1961) along Tree River south of Port Epworth in Coronation Gulf. If this date is confirmed by others, it would suggest a very rapid disintegration of the ice mass (lobe), which, in late glacial time, occupied the Amundsen Gulf Dolphin and Union Strait, Coronation Gulf depression.

GSC-4103. Netla River 5750 ± 60
$\delta^{13}C$= -28.5‰

The wood (*Betula*; identified by H. Jetté (unpublished GSC Wood Report No. 85-74)) was enclosed in sand. Sample DGS-85-6 was collected by D.G. Smith on June 25, 1985, 16 km upriver from the Netla River confluence or 42 km upriver from Nahanni Butte, District of Mackenzie, Northwest Territories (60°55′N, 124°30′W), at an elevation of 190 m; submitted by D.G. Smith.

The sample (12.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5810 ± 60.

Comment (D.G. Smith): The date of 5810 ± 60 BP (GSC-4103) provides a first approximation of the meandering river point bar terraces in the Nahanni Butte basin. It was hoped that the date would provide an age associated with the Late Pleistocene Laird River Delta deposited in Glacial Lake McConnell.

Tuktoyaktuk Series

A series of wood samples from 200 km east of Tuktoyaktuk, District of Mackenzie, Northwest Territories (69°30.6′N, 127°2.2′W), at an elevation of approximately 230 m, were collected by W.H. Mathews on June 26, 1982; submitted by W.H. Mathews.

GSC-4260. Tuktoyaktuk (I) >34 000
$\delta^{13}C$= -26.3‰

The wood (sample W.H.M. No. 14; 13.8 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 86-22)), enclosed in grey gravel, stony silt, and layers of twigs and duff, was treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 5760 minutes (one 4 day) in the 5 L counter with a mixing ratio of 1.00.

GSC-4260-2. Tuktoyaktuk (II) >37 000
$\delta^{13}C$= -24.4‰

A second preparation of the wood (sample W.H.M. No. 14; 9.0 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on three counts for 4140 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (W. Mathews): A nonfinite age was expected.

Comment (J-S. Vincent): This sample was dated as a verification of a U/Th age of 37 700 ± 1200 BP.

GSC-4209. "Avalanche Lake" 480 ± 50
$\delta^{13}C$= -26.1‰

The wood (*Picea* sp.; identified by H. Jetté (unpublished GSC Wood Report No. 86-8)) was beneath rock in rockslide debris. Sample EN-AVL-TR3 was collected by P. Kaiser and J. Simmons on June 10, 1980 from 26.25 km north-northeast of junction between Broken Skull River and South Nahanni River, above "Avalanche Lake", District of Mackenzie, Northwest Territories (62°25′N, 127°15′W), at an elevation of approximately 1800 m; submitted by S.G. Evans.

The sample (11.5 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2430 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 500 ± 50.

Nicholson Point Series

A series of wood and moss samples from mainland coast, south of Nicholson Island, approximately 12 km southwest of Nicholson Point DEW Line site, District of Mackenzie, Northwest Territories (69°50′N, 129°10′W), were collected by D.G. Harry on June 6, 1986; submitted by D.G. Harry.

GSC-4362. Nicholson Point (I) 9020 ± 150
$\delta^{13}C$= -31.2‰

The wood and moss (sample DGH-86-3; 6.8 g dry weight; *Betula*; identified by H. Jetté (unpublished GSC Wood Report No. 86-62)), enclosed in organic silt, at an elevation of 10 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.68.

The uncorrected age is 9120 ± 150.

GSC-4375. Nicholson Point (II) >35 000
$\delta^{13}C$= -22.6‰

The wood (sample DGH-86-4; 3.0 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-63)), enclosed in silt/clay diamicton, at an elevation of 8 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 7080 minutes (one 5 day) in the 2 L counter with a mixing ratio of 1.81.

GSC-4329. Liverpool Bay 4310 ± 70
$\delta^{13}C$= -23.5‰

The wood (*Picea* (spruce); identified by J.C. Ritchie) was enclosed in debris. Sample 29 RCM was collected by V.N. Rampton on July 7, 1986 from the shore of Liverpool Bay, north-northeast of Campbell Island, Tuktoyaktuk Peninsula, District of Mackenzie, Northwest Territories (69°41′N, 130°51′W), at an elevation of 20 m; submitted by J.C. Ritchie.

The sample (11.1 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4280 ± 70.

Eskimo Lakes Series

A series of wood samples from the south shore of the Eskimo Lakes approximately 45 km south-southeast of Tuktoyaktuk, District of Mackenzie, Northwest Territories (69°8′N, 132°45′W), were collected by D.G. Harry on June 2, 1986; submitted by D.G. Harry.

GSC-4351. Eskimo Lakes (I) 5200 ± 60
$\delta^{13}C$= -25.3‰

The wood (sample DGH-86-2; 8.5 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-61)), enclosed in sand, at an elevation of 10 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4140 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5200 ± 60.

GSC-4349. Eskimo Lakes (II) >36 000

The wood (sample DGH-86-1; 5.4 g dry weight; *Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-60)), enclosed in sand, at an elevation of 12 m, was treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 1320 minutes (one 1 day) in the 2 L counter with a mixing ratio of 1.16.

Rat River Series

A series of peat and wood samples from a river bluff along Rat River were collected and submitted by N.R. Catto. Four additional samples GSC-3371, -3399, -3565, and -3813 have been reported in McNeely (1989).

GSC-3797. Rat River (I)
uncorrected 990 ± 50

The peat (sample HHC-81-6-17; 546.7 g wet weight), enclosed in peat, was collected 70 km northwest of Fort McPherson, District of Mackenzie, Northwest Territories (67°44′N, 136°3′W), at an elevation of 272 m on August 4, 1981. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.0.

Comments (N.R. Catto): The peat sample was obtained 15 cm below the upper surface of a 2.1 m thick peat deposit overlying glacial outwash gravels, which are 30 m thick.

The base of the peat unit has been dated at 8280 ± 110 BP (GSC-3399, McNeely, 1989). Palynological analysis of the upper portion of the peat unit revealed an assemblage dominated by *Picea* type *glauca*, *Alnus* type *crispa*, *Betula*, Ericaceae, Cyperaceae, and Gramineae (identified by N.R. Catto). These taxa, together with the remainder of the assemblage, suggest that the depositional setting was a relatively dry slope adjacent to the braided Rat River, and that the climate was similar to that prevalent in the region today. Gradual climatic amelioration, punctuated by minor fluctuations, is indicated by the complete sequence of palynomorphs present throughout the thickness of the peat deposit. Additional samples submitted for radiocarbon dating will enable assessment of the chronology of climatic amelioration in the McDougall Pass region.

GSC-3715. Rat River (II) 1070 ± 70
$\delta^{13}C$= -28.4‰

The wood (sample HHC-81-Rg-11; 2.9 g dry weight; *Alnus*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-36)), enclosed in silt, was collected 55 km northwest of Fort McPherson, District of Mackenzie, Northwest Territories (67°42′N, 135°49′W), at an elevation of 200 m, on July 24, 1981. The sample was treated with hot

base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.59.

The uncorrected age is 1120 ± 70.

Comments (N.R. Catto): The sample of wood was obtained from a silt stratum that was located in the basal portion of a fluvial sedimentary sequence. The fluvial sequence overlay a silty diamicton that contained granitic clasts derived from the Canadian Shield. The diamicton is the oldest unit exposed at the section that contains Canadian Shield-derived clasts.

The result indicated that the fluvial unit is a recent fill deposit formed by an abandoned meander loop, which has been truncated by the modern Rat River. The river therefore had initially aggraded at least 2 m (as represented by the thickness of overlying fluvial sediment) and subsequently dropped at least 11.5 m since 1070 BP. Needles present in the sample have been identified as *Picea* by J.V. Matthews, Jr. (pers. comm., 1984).

NORTHERN CANADA, ARCTIC ARCHIPELAGO

Baffin Island

GSC-3603. Frobisher Bay 8030 ± 80
$\delta^{13}C = +1.2‰$

The marine shells (*Mya truncata*; identified by G.H. Miller) were enclosed in medium sand. Sample A10-S7 (1982) was collected by J.A. Stravers on August 10, 1982 from 5 km southeast of Buerger Point, outer Frobisher Bay along the south side, southern Baffin Island, District of Franklin, Northwest Territories (62°18′N, 66°10′W), at an elevation of 5-6 m; submitted by G.H. Miller.

The sample (33.0 g dry weight) was treated with an acid leach to remove the outer 5% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8020 ± 80.

Comment (J.A. Stravers and G. H. Miller): We interpret the enclosing sediments as deltaic sands; however, there is no obvious stream source at present. The terrace surface at this site is 9 m a.h.t. and may represent sea level at 8.0 ka, although there has been a great deal of erosion of Holocene sediments along this peninsula. The sample represents a sea level of at least 9 m. Other dates from this area suggest sea level at 8.0 ka was about 10 m a.h.t. but fell below present sea level in the next 1-2 millennia. The marine limit is 67 m a.h.t. at Buerger Point, 5 km to the northwest.

GSC-4578. Meta Incognita Peninsula 8250 ± 180
$\delta^{13}C = +2.1‰$

The marine shells (mostly *Mya truncata*; identified by G.H. Miller) were enclosed in well sorted marine sand. Sample M86 BS1 was collected by G.H. Miller on July 26, 1986 from a small bay about half way between Buerger Point and Halford Island, southeastern Meta Incognita Peninsula, Baffin Island, District of Franklin, Northwest Territories (62°18.6′N, 66°10.4′W), at an elevation of 3 m a.h.t.; submitted by G.H. Miller.

The sample (7.3 g dry weight) was treated with an acid leach to remove the outer 5% of the sample. The age estimate is based on two counts for 2850 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.93.

The uncorrected age is 8210 ± 180.

Comment (G.H. Miller): Shells were collected from laminated sands with fine cross stratification 3 m a.h.t.; the top of the sandy delta in which they were found was 8 m a.h.t. Some shells were paired. There were no indications of calving glacier ice in the vicinity at this time, but ice was close by as recently as 9.0 ka (8970 ± 135 BP; GX-13021, Miller unpublished, on shells in glacio-marine silts at the same site). The shells are interpreted to date a sea level 8 m above present. Marine limit in the Jackman Sound - Henderson Inlet region is 75-80 m a.h.t.; deglaciation occurred between 9.0 and 9.5 ka. Sea level fell rapidly from the marine limit phase to below present sea level by about 7.0 ka.

"The Bastions Moraine" Series

A series of marine shell samples from just north of "The Bastions Moraine", outer Buchan Gulf, northern Baffin Island, District of Franklin, Northwest Territories, were collected by J.A. Stravers on August 10, 1986; submitted by J.A. Stravers.

GSC-4366. "The Bastions Moraine" (I) 7310 ± 70
$\delta^{13}C = +0.2‰$

The marine shells (sample Feachem Valley 4; 40.6 g dry weight; *Mytilus edulis*; identified by J.A. Stravers), enclosed in deltaic sands, were collected from a stream cut 0.5 km upstream from Baffin Bay shore on south bank of the stream draining the large lake to the north of the "The Bastions" (75°54.9′N, 74°13.5′W), at an elevation of 19 m. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7310 ± 70.

Comments (J.A. Stravers): This sample dates a relative sea level between 22 and 26 m (elevation of deltaic topsets)on the outer coast of Baffin Island. The local marine limit lies at 32 m. The deltaic sands overlie the stony muds of GSC-4357.

GSC-4357. "The Bastions Moraine" (II) 8130 ± 110
$\delta^{13}C$= -0.0‰

The marine mollusc shells (sample Feachem Valley 2; 34.6 g dry weight; *Mya truncata* and *Hiatella arctica*; identified by J.A. Stravers), enclosed in stony mud, were collected from a stream cut 1 km upstream from Baffin Bay shore (71°55′N, 74°14′W), on south bank of stream draining the large lake to the north of "The Bastions", at an elevation of 20 m. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2570 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8130 ± 110.

Comments (J.A. Stravers): Although the stoney mud at this site is not well-exposed, it appears to lie on the top or onlap the seaward flank of "The Bastions Moraine" (Hodgson and Hasselton, 1974). The origin of the stony mud may relate to a period of active ice rafting of debris to outer Buchan Gulf, or it may have been produced by wave erosion of "The Bastions Moraine" during sealevel regression. The local marine limit lies at 32 m, and this date is a minimum age for that limit.

GSC-3959. Cape Dorset 7720 ± 100
$\delta^{13}C$= +1.8‰

The marine shells (*Hiatella arctica*; identified by C.A. Laymon) were enclosed in sand-silt-clay. Sample CL/84/CD/M71 was collected by C.A. Laymon in July, 1984 from about 17 km northwest of Cape Dorset, Baffin Island, District of Franklin, Northwest Territories (64°22′N, 76°44′W), at an elevation of 136 m; submitted by C.A. Laymon.

The sample (27.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2270 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7690 ± 100.

Comment (C.A. Laymon): A sample of in situ paired valves was collected from a unit of at least 4 m of marine mud, which represented a distal facies of a large ice contact delta that existed about 1 km to the north with a maximum elevation of 187 m a.h.t. This marine mud was overlain by another delta composed of about 20 m of sand. This shell date provides a good estimate of the age of ice recession onto southern Foxe Peninsula and the age of the marine limit.

Paquet Bay Series

A series of marine shell samples from Paquet Bay area, northern Baffin Island, District of Franklin, Northwest Territories were collected by J.A. Stravers on August 5, 1986; submitted by J.A. Stravers.

GSC-4379. Paquet Bay (I) 4900 ± 70
$\delta^{13}C$= +2.8‰

The marine shell fragments; (sample P.B. 8; 44.6 g dry weight; *Mya truncata* and *M. arenaria*; identified by J.A. Stravers), enclosed in well sorted delta sands, from the west bank, 1 km upstream from the mouth on the main river flowing into the east arm of Paquet Bay (71°44′45″N, 77°42.75′W), at an elevation of 21 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4850 ± 70.

Comments (J.A. Stravers): This sample relates to a former sea level of 28 to 30 m.a.h.t. (elevation of topset beds underlying a prominent terrace surface at this site). The local marine limit lies at 82 m.

GSC-4392. Paquet Bay (II) 5190 ± 90
$\delta^{13}C$= +0.8‰

The marine shells; (sample P.B. 16; 16.0 g dry weight; juvenile *Mya truncata*; identified by J.A. Stravers), enclosed in well sorted deltaic sands, from a deep stream-cut gully along the south bank of the first major tributary to the main river that flows into the east arm of Paquet Bay, 1.7 km from the tributary's junction with the main river, (71°43′20″N, 77°42′W), at an elevation of 41 m, were treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2080 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.45.

The uncorrected age is 5180 ± 90.

Comments (J.A. Stravers): This sample approximates a sea level of 49 m (elevation of topset beds underlying a prominent terrace surface between 49 and 51 m.a.h.t.), inner Paquet Bay. The local marine limit lies at 82 m.

GSC-4317. Tay Sound 7010 ± 90
$\delta^{13}C$= +1.4‰

The marine pelecypod shells (*Hiatella arctica* and *Mytilus edulis*; identified by J.A. Stravers) were enclosed in stony mud. Sample Tay Sound 2 was collected by J.A. Stravers on July 18, 1986 from northwest stream bank, 4 km southwest of stream mouth at the southwestern "elbow" of Tay Sound, northern Baffin Island, District of Franklin, Northwest Territories (71°57′N, 79°16′ 30″W), at an elevation of 60 m; submitted by J.A. Stravers.

The sample (18.6 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2670 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.22.

The uncorrected age is 6990 ± 90.

Comments (J.A. Stravers): The stratigraphic section consists of 4 m of stoney muds (outcropping above the stream) overlain by 14 m of coarse ice proximal/contact deltaic sands. The delta surface lies at 78 m.a.h.t. The stony

mud indicates the presence of tide water glaciers in Tay Sound as late as 7.0 ka, and the date is a minimum age estimate for a sealevel at 78 m.a.h.t..

Banks Island

Banks Island Series

A series of lake sediment samples from Banks Island, District of Franklin, Northwest Territories (71°47′N, 122°40′W), at an elevation of 363 m, were collected by J.C. Ritchie and R.W. Spear in May, 1982; submitted by J.C. Ritchie.

GSC-3818. Banks Island (I) 8600 ± 140
$\delta^{13}C$= -27.6‰

The lake sediment (mud sample MOX 1 (80-87; 50.7 g dry weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.63.

The uncorrected age is 8640 ± 140.

GSC-3814. Banks Island (II) 10 900 ± 120
$\delta^{13}C$= -27.8‰

The lake sediment, mud (sample MOX 2 (102-109); 62.1 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4020 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.40.

The uncorrected age is 10 900 ± 120.

GSC-3803. Banks Island (III) 12 200 ± 130
$\delta^{13}C$= -28.2‰

The lake sediment, mud (sample MOX 3 (127-133); 62.5 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.38.

The uncorrected age is 12 300 ± 130.

GSC-3795. Banks Island (IV) 10 600 ± 120
$\delta^{13}C$= -29.3‰

The lake sediment, mud (sample MOX 4 (162-168); 32.5 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.47.

The uncorrected age is 10 700 ± 120.

Comment (J.C. Ritchie): A preliminary pollen diagram shows stratigraphic patterns that parallel the sequences established for Tuktoyaktuk Peninsula, and the dated levels were chosen accordingly. From bottom to top, the pollen sequence is a herb zone, a birch rise, a spruce rise, and finally an alder rise. It is unlikely that several of the main pollen taxa show changes that occurred on the mainland, rather than locally on Banks Island. A survey of modern pollen showed recently (Ritchie et al., 1987) that local pollen taxa are underrepresented. Unfortunately, the four dates are not in sequence, so the diagram has not been published.

Bathurst Island

GSC-4176. Cracroft Sound 9850 ± 150
$\delta^{13}C$= +2.9‰

The marine shell fragments (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in gravel and silt. Sample HCA-85-13-8-2 was collected by D.A. Hodgson on August 13, 1985 from the south shore of Cracroft Sound, 5 km east of Cape Sophia, Bathurst Island, District of Franklin, Northwest Territories (76°36.5′N, 98°48′W), at an elevation of approximately 150 m; submitted by D.A. Hodgson.

The sample (12.2 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2130 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.77.

The uncorrected age is 9810 ± 150.

GSC-4105. Dyke Acland Bay 5400 ± 70
$\delta^{13}C$= -23.6‰

The wood, driftwood (*Picea* or *Larix*; identified by H. Jetté (unpublished GSC Wood Report No. 85-69)) was enclosed in carbonate and silt in beach ridges. Sample HCA-85-11-8-4 was collected by G. Parkin on August 11, 1985 from 3 km west of southwest entrance to Dyke Acland Bay, Bathurst Island, District of Franklin, Northwest Territories (75°0′N, 99°3′W), at an elevation of 29 m; submitted by D.A. Hodgson.

The sample (11.7 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2060 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5380 ± 70.

Byam Martin Island

GSC-3740. Cape Gillman 9500 ± 100
$\delta^{13}C$= +1.5‰

The marine shells (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in stony, silty sand. Sample HCA-83-27-7-4 was collected by D.A. Hodgson on July 27, 1983 from 7 km northwest of Cape Gillman, southern Byam Martin Island, District of Franklin, Northwest Territories (75°4′N, 104°24′W), at an elevation of 74 m; submitted by D.A. Hodgson.

The sample (49.4 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on three counts for 4060 minutes (three 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9480 ± 100.

Cape Smith Island

GSC-4332. Akulivik 6850 ± 110
$\delta^{13}C = +1.4‰$

The marine shells (*Hiatella arctica*; identified by B. Lauriol) were enclosed in silt and pebbles. Sample CS-3A was collected by B. Lauriol and C. Prevost on August 6, 1986 from 10 km southwest of Akulivik, Cape Smith Island, Hudson Bay, District of Franklin, Northwest Territories (60°45′N, 78°27′50″W), at an elevation of 86 m; submitted by B. Lauriol.

The sample (39.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2250 minutes (two 1-day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6820 ± 110.

Comment (B. Lauriol): L'échantillon GSC-4332 (6850±110) a été daté pour vérifier la date UQ-761 qui a fourni un age de 8040 ± 110 LBP. Les 2 échantillons (GSC-4332 et UQ-761) ont été prélevés par B. Lauriol sur le même site, à 2 ans d'intervalle (1984 et 1986). Il existe une différence de 1190 ans entre les 2 échantillons. Les courbes d'émersion ne permettent pas de dire lequel des 2 échantillons a fourni la date la plus vraisemblable.

Cornwall Island

GSC-4233. Cape Butler/Cape O'Brien 8700 ± 160
$\delta^{13}C = +2.2‰$

The marine pelecypod shell fragments (unidentified) were enclosed in sand with some coal fragments. Sample HCA-79-5-8-1G was collected by D.A. Hodgson in 1979 from 4 km inland, between Cape Butler and Cape O'Brien, southwest Cornwall Island, District of Franklin, Northwest Territories (77°30.8′N, 95°34′W), at an elevation of 47 m; submitted by D.A. Hodgson.

The sample (7.3 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 3.14.

The uncorrected age is 8660 ± 160.

Ellesmere Island

GSC-4634. Colan Bay 120 ± 50
$\delta^{13}C = -25.0‰$

The wood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 88-8)) was from a surface collection. Sample McK-87-1 was collected by R.G. McKay in August of 1987 from the east side of Colan Bay, Ellesmere Island, District of Franklin, Northwest Territories (82°30′N, 62°45′W), at an elevation of less than 1 m; submitted by W. Blake, Jr.

The sample (11.4 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2370 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 120 ± 50.

Comment (W. Blake, Jr.): This age determination shows that modern wood is reaching the eastern part of the northern coast of Ellesmere Island at the present time. The same is true for other parts of the archipelago; cf. GSC-1793, modern wood found on multiyear sea ice in Nansen Sound (Lowdon and Blake, 1978).

GSC-4597. Bartlett Bay 6530 ± 70
$\delta^{13}C = +3.8‰$

The marine pelecypod shells (*Mya truncata*; identified by W. Blake Jr.) were enclosed in pebbly silt and clay. Sample 86-BS-136 was collected by W. Blake, Jr., K.A. Eyvinds, and K.E. Rolko on June 26, 1986 from north side of Bartlett Bay, Bache Peninsula, Ellesmere Island, District of Franklin, Northwest Territories (79°11.6′N, 74°42.0′W), at an elevation of 30-35 m; submitted by W. Blake, Jr.

The sample (46.7 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6470 ± 70.

Comment (W. Blake, Jr.): The result is in close agreement with a date of 6920 ± 140 BP (GSC-2937; Blake, 1987) on *Mya truncata* shells from raised beaches at 62 m some 2.5 km southwest of Cape Henry, also on the east coast of Bache Peninsula.

GSC-4734. Sawtooth Range 330 ± 50
$\delta^{13}C = -27.9‰$

The peat (sample SAW 1), overlain by till, was collected by B.H. Luckman on July 9, 1988 from about 100 m from the eastern glacier at the north end of Sawtooth Range, about 7 km west-southwest of Cape With, Fosheim Peninsula, Ellesmere Island, District of Franklin, Northwest Territories (79°54′N, 83°14′W), at an elevation of 450 m; submitted by B.H. Luckman.

The sample (250 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2350 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 380 ± 50.

Comment (B.H. Luckman): This sample was obtained during a reconnaisance survey of the glaciers on the western flanks of Sawtooth Range. The eastern tongue of the northernmost glacier has a well defined recent limit approximately 0.5-1.0 km beyond the present ice limit. The sample was recovered from a small stream section in the centre of the forefield, less than 100 m from the snout and within this limit. Similar sections were exposed for 3-5 m on both sides of the creek and consisted of 6-7 cm soil-organics; 20-30 cm stony buff till; 0-20 cm peat and/or oxidized soil (this sample); 20 cm silt with organic lenses (rest of section, about 1 m, was covered by slumping). The sample was derived from a freshly exposed face and a bulk sample of the uppermost peat was dated. This radiocarbon date confirms that the advance and overlying thin till are Little Ice Age events. Similar Little Ice Age glacier advances have been recognized from elsewhere in Ellesmere Island and adjacent Arctic Islands (see review in Blake, 1981).

Atwood Point Series

A series of marine shell samples from the Atwood Point area, north shore of Greely Fiord, Ellesmere Island, District of Franklin, Northwest Territories, were collected and submitted by J. Bednarski.

GSC-4535. Atwood Point (I) 7430 ± 80
$\delta^{13}C = +1.3‰$

The marine pelecypod shells (sample AP.87.5.S; 33.6 g dry weight; *Hiatella arctica* and *Mya truncata*; identified by J. Bednarski), enclosed in silty gravel, from 9 km west of Atwood Point (80°31′N, 84°20′W), at an elevation of 59 m, were collected on July 16, 1987. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 3980 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7410 ± 80.

Comment (J. Bednarski): This sample is in a similar stratigraphic position to GSC-4621 (18 000 ± 190 BP) collected 2 km to the west, and only 8 m lower in elevation. However, the large difference in age suggests that the area was subjected to an elevated sea level for a long period of time (throughout late glacial times).

GSC-4621. Atwood Point (II) 18 000 ± 190
$\delta^{13}C = +2.4‰$

The marine shells (sample AP.87.2.S; 30 g dry weight; *Mya truncata* and *Hiatella arctica*; identified by J. Bednarski), enclosed in sandy-silt to sand, from Atwood Point (80°31′N, 84°15′W), at an elevation of 67 m, were collected on July 13, 1987. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 18 000 ± 190.

Comment (J. Bednarski): The sample age is significant because it implies the presence of a sea and not glacier ice within Outer Greely Fiord during the Late Wisconsinan maximum. The paired state of some valves from the sandy terrace and their similar appearance does not seem to indicate glacier transport or a population of mixed ages. AMS dates or individual pieces could prove this definitively.

Otto Fiord Series

A series of marine shell and organic samples from the Otto Fiord area, Ellesmere Island, District of Franklin, Northwest Territories, were collected and submitted by J. Bednarski.

GSC-4561. Otto Fiord (I) 6360 ± 70
$\delta^{13}C = +1.0‰$

The marine pelecypod shells (sample OF.87.23.S; 46.3 g dry weight; *Hiatella arctica* and *Mya truncata*; identified by J. Bednarski), enclosed in silt, from the eastern side of the mouth of Lindstroem Creek (81°3′N, 88°47′W), at an elevation of 24 m, were collected on July 7, 1987. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2040 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6340 ± 70.

Comment (J. Bednarski): The sample comes from silt deposited during a sea level higher than 24 m, perhaps when a prominent beach formed at 46 m (about 300 m upslope). A great abundance of shells within the silts indicate very favourable conditions for growth during this time.

GSC-4511. Otto Fiord (II) 7730 ± 100
$\delta^{13}C = +3.0‰$

The marine pelecypod shells (sample OF.87.25.S; 25.6 g dry weight; *Hiatella arctica* and *Mya truncata*; identified by J. Bednarski), from a surface collection on a sand and gravel beach, Lindstroem Creek (81°3′N, 88°45′W), at an elevation of 46 m, were collected on July 7, 1987. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2650 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7680 ± 100.

Comment (J. Bednarski): The date provides a minimum age for the 46 m beach however, given the other dates in the area, the shells must relate to a higher sea level.

GSC-4617. Otto Fiord (III) 7920 ± 110
$\delta^{13}C = +3.3‰$

The marine pelecypod shells (sample OF.87.17.S; 19.8 g dry weight; *Mya truncata*; identified by J. Bednarski), enclosed in fine sand, from the west side of stream mouth, north shore of Otto Fiord, about 3 km east of the mouth of Lindstroem Creek (81°3′N, 88°41′W), at an elevation of 26 m, were collected on July 4, 1987. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2090 minutes in the 2 L counter with a mixing ratio of 1.27.

The uncorrected age is 7870 ± 110.

Comment (J. Bednarski): The sample provides a minimum age estimate for the 82 m a.s.l. relative sea level. Evidence of sea levels up to 92 m occurs upvalley.

GSC-4530. Otto Fiord (IV) 8000 ± 100
$\delta^{13}C = -26.6‰$

The organic material, tundra plants (sample OF.87.2.ORG; 58.0 g wet weight; sedges), enclosed in fine sand, from just north of the mouth of Otto Fiord, on the tip of Hvitland Peninsula, on the shore of Nansen Sound (81°2′N, 89°56′W), at an elevation of 38 m, were collected on July 1, 1987. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2690 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8020 ± 100.

Comment (J. Bednarski): This date agrees with dates TO-981 (8070 ± 60 BP) and GSC-4531 (8270 ± 140 BP) obtained from shells within the same stratigraphic unit. The age is a minimum on the 55 m sea level. The terrace was probably recent to this sea level.

GSC-4531. Otto Fiord (V) 8270 ± 140
$\delta^{13}C = +2.9‰$

The marine pelecypod shells (sample OF.87.10.S; 14.3 g dry weight; *Hiatella arctica* and *Mya truncata*; identified by J. Bednarski), enclosed in sand, from just north of the mouth of Otto Fiord, on the tip of Hvitland Peninsula, on the shore of Nansen Sound (81°2′N, 89°56′W), at an elevation of 38 m, were collected on July 1, 1987. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2320 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.70.

The uncorrected age is 8230 ± 140.

Comment (J. Bednarski): Given the sample age, the 55 m terrace has been recut to this elevation. Similar dates along this coastline relate to sea levels just over 100 m a.s.l. This date is in good agreement with GSC-4530, TO-981, and -982.

Associated AMS Dates (IsoTrace Laboratory)

TO-981. Otto Fiord (VI) 8070 ± 60

A marine pelecypod shell (*Mya truncata*; identified by J. Bednarski) from sample OF.87.10.S, cf. GSC-4531, was treated with an acid leach to remove the outer 30% of the sample.

Comment (J. Bednarski): GSC-4531 was small, therefore the error is large. Another consideration on comparing the dates is the fact that the GSC sample was a mixed collection of *Hiatella* and *Mya*. The ages (corrected to 0.0‰ $\delta^{13}C$) were 8270 ± 140(2s) BP and 8070 ± 60(1s) BP (GSC and TO, respectively); because their error limits overlap, the dates are considered to be in satisfactory agreement.

TO-982. Otto Fiord (VII) 8220 ± 70

The organic siphon sheath (sample OF.87.10.P) was removed from the shell sample OF.87.10.S (cf. TO-981) prior to leaching of the shell and was dated separately at IsoTrace.

Comment (R. McNeely): This suite of samples allows the comparison of a mixed shell collection with a single shell and its associated organic material. All the ages (8270 ± 140 BP, 8070 ± 60 BP and 8220 ± 70 BP) were corrected to 0.0‰ $\delta^{13}C$. The dates are considered to be in satisfactory agreement: the AMS dates on the shell and its siphon sheath dates are in close agreement; the siphon sheath (TO) and 'mixed shell' (GSC) dates agree very well; and the two shell dates (GSC and TO) are considered to be in reasonable agreement. These dates suggest that shell organic material age determinations are comparable to shell dates if both materials are normalized/corrected to the same value.

Cape Coastguard Series

A series of marine shell samples from the Cape Coastguard area, between Emma and Jugeborg fiords, Ellesmere Island, District of Franklin, Northwest Territories, were collected and submitted by J. Bednarski.

GSC-4596. Cape Coastguard (I) 5330 ± 70
$\delta^{13}C = +1.6‰$

The marine pelecypod shells (sample EF.87.2.S; 56.6 g dry weight; *Hiatella arctica* and *Mya truncata*; identified by J. Bednarski), enclosed in silt, from 7 km southeast of Cape Coastguard (81°17′N, 89°38′W), at an elevation of 12 m, were collected on June 20, 1987. The sample was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on two counts for 2150 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5300 ± 70.

Comment (J. Bednarski): Given the earlier dates on deglaciation along this coast, it is apparent that the date is related to a younger, lower sea level.

GSC-4582. Cape Coastguard (II) 8530 ± 80
$\delta^{13}C$= +3.2‰

The marine pelecypod shells (sample EF.87.5.5; 48.8 g dry weight; *Mya truncata* and *Hiatella arctica*; identified by J. Bednarski), from the surface of a silty diamicton, 5 km southeast of Cape Coastguard (81°19'N, 89°42'W), at an elevation of 39.5 m, were collected on June 22, 1987. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8480 ± 80.

Comment (J. Bednarski): The sample provides a minimum age of deglaciation of outer Cape Coastguard and a maximum age for a prominent moraine about 2 km landward.

Lougheed Island

GSC-4384. Lougheed Island 9470 ± 120
$\delta^{13}C$= +0.9‰

The marine shells (*Hiatella arctica*; identified by G. Vilks) were enclosed in sandy silt. Sample 86-100-6 was collected by G. Vilks on July 13, 1986 from the southern tip of Lougheed Island, District of Franklin, Northwest Territories (77°10.7'N, 104°40.0'W), at an elevation of 17.4 m; submitted by G. Vilks.

The sample (16.1 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2170 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.37.

The uncorrected age is 9450 ± 120.

Comment (G. Vilks): The sediment where shells were embedded also contains benthic foraminifera and trace planktonic foraminifera. The species composition of these indicate marine environment at mid-shelf depths with less extensive perennial sea ice than at present.

GSC-4249. Lougheed Island 8780 ± 100
$\delta^{13}C$= -25.3‰

The wood fragments (*Pinus strobus*; identified by H. Jetté (unpublished GSC Wood Report No. 86-26)) were from a surface collection on silty sand. Sample HCA-79-1-8-2 was collected by D.A. Hodgson on August 1, 1979 from northwest Lougheed Island, District of Franklin, Northwest Territories (77°30'N, 105°37'W), at an elevation of 30 m; submitted by D.A. Hodgson.

The sample (14.0 g dry weight) was treated with hot base, hot acid, and distilled water rinses. The age estimate is based on one count for 5440 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8780 ± 100.

Melville Island

Drake River Series

A series of samples collected from fluvial-deltaic terrace deposits along tributary and lower 8 km reach of 'Drake River' (informal designation), which empties into Byam Martin Channel at 76°25'N, 108°30'W, 5 km south of Drake Point, east coast of Sabine Peninsula, Melville Island, District of Franklin, Northwest Territories. The samples were collected and submitted by D.L. Forbes and R.B. Taylor. Further details and locations of collection sites are given in Forbes et al. (1986).

GSC-4386. Drake Point (I) 7060 ± 190
Site 17 $\delta^{13}C$= -28.3‰

The gnarled and fragmented wood (sample 8607030; 10 x 150 mm; 2.6 g dry weight; *Salix*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-07)), 5.5 m below upper surface of a 21 m terrace on the south bank of 'Drake River', 4 km from the mouth (76°23.9'N, 108°37.7'W), at an elevation of approximately 15 m, was collected on July 29, 1986 from a silt-sand delta foreset unit. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2380 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.17.

The uncorrected age is 7120 ± 190.

GSC-4373. Drake Point (II) 8010 ± 110
Site 2 $\delta^{13}C$= +2.5‰

The marine pelecypod shells (sample 8607032; 18.4 g dry weight; *Astarte crenata*; identified by F. Cole), in association with *Hiatella arctica* and plant fragments (see GSC-4469), 11 m below upper surface of a 22 m terrace on the south bank of 'Drake River', 4.5 km from the mouth (76°24.6'N, 108°38.3'W), at an elevation of approximately 11 m, were collected on July 29, 1986 from a delta toeset pebbly mud immediately above the contact with a shell-bearing black organic mud. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.02.

The uncorrected age is 7970 ± 110.

GSC-4469. Drake Point (III) 8420 ± 100
Site 2 $\delta^{13}C$= -28.0‰

The plant fragments with twigs (2 x 50 mm and 3 x 30 mm) and moss (sample 8607005; 11.6 g dry weight), were collected on July 23, 1986 from the same horizon as GSC-4373, from an organic-rich silt-sand layer in a delta toeset pebbly mud, immediately above the contact with a shell-bearing black mud, and overlain by 1 m of shell-bearing pebbly silt and sand, and a 10 m foreset deposit of silty sand. The sample was treated with hot base, hot acid (slightly

calcareous), and distilled water rinses. The age estimate is based on two counts for 2390 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8470 ± 100.

GSC-4395. Drake Point (IV)
Site 7 uncorected 9260 ± 120

The organic plant fragments (sample 8607019; 121.6 g wet weight), 7 m below upper surface of a 16 m terrace on the east bank of a tributary, 2.5 km above its confluence with 'Drake River', 1.5 km from the mouth (76°3.5'N, 108°31.6'W), at an elevation of 9 m, were collected on July 25, 1986 from an organic-rich layer in a delta foreset silt-sand unit. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2310 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.31.

GSC-4376. Drake Point (V)
Site 6 uncorrected 14 200 ± 130

The organic plant fragments (sample 8607016; 97.8 g wet weight), 5 m below upper surface of a 27 m terrace on the south bank of 'Drake River', 8 km from the mouth (76°23.9'N, 108°42.9'W), at an elevation of approximately 22 m, were collected on July 25, 1986 from an organic-rich layer in a foreset silt-sand unit. The sample was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (D.L. Forbes): GSC-4373, -4469, and -4386 add to the limited information available on postglacial relative sea level changes in the Sabine Peninsula area. On the other hand, GSC-4376 and -4395 reflect long storage times for some reworked plant materials, which predate the terraces in which they occur by several thousand years and therefore provide no information on sea levels. The only relevant dates previously available for Sabine Peninsula were a series from the Sherard Bay area (GSC-1624, -1636, -1708, -1752: Barnett, 1973; GSC-1652: McLaren and Barnett, 1978), 40 km to the south, and another series from the Weatherall Bay area (I(GSC)-21, I-730: Henoch, 1964; GSC-1688 and -1721: McLaren and Barnett, 1978), 25 km southeast of Sherard Bay. GSC-4373, -4469, and -4386 are not inconsistent with an emergence curve based on the Sherard Bay dates and younger dates from Weatherall Bay (Forbes et al., 1986). The anomalous nature of the earlier and higher dates obtained by Henoch (1964) in the Weatherall Bay area has been noted previously by McLaren and Barnett (1978). There is evidence to suggest that the postglacial marine limit rises toward the south and east, from 70 m between Sherard Bay and Weatherall Bay to 101 m at Towson Point on the east coast (McLaren and Barnett, 1978). Although the new dates reported here may be taken to suggest a slightly lower curve in the 'Drake River' area than that determined for Sherard Bay, no definitive conclusion can be drawn because of possible errors in the specification of sea levels, uncertainties in the reservoir age for shells in this region, and unknown storage times for the transported plant materials. Although GSC-4373 and -4469 (shells and plant fragments from the same horizon) differ by less than 500 years, the possibility exists that any of the samples composed of fine plant fragments may be contaminated by anomalously old material. A nonfinite age of >41 ka (GSC-1609; Lowdon and Blake, 1973) has been obtained on a wood fragment of *Larix* collected at an elevation of 69 m in the Drake Point area (Barnett, 1973).

GSC-4187. Purchase Bay 7890 ± 70
$\delta^{13}C = -25.4‰$

The peat (sample HCA-85-10-7-1C) was collected by D.A. Hodgson on July 10, 1985 from south central Purchase Bay, Melville Island, District of Franklin, Northwest Territories (75°28'N, 115°53'W), at an elevation of 70 ± 5 m; submitted by D.A. Hodgson.

The sample (40.5 g wet weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7890 ± 70.

GSC-4167. Comfort Cove 11 700 ± 110
$\delta^{13}C = +0.6‰$

The marine shells (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in stony silt. Sample HCA-85-9-7-3a was collected by D.A. Hodgson on July 9, 1985 from 1 km south of Comfort Cove, Melville Island, District of Franklin, Northwest Territories (75°18.3'N, 117°35'W), at an elevation of 6 m; submitted by D.A. Hodgson.

The sample (26.7 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 11 700 ± 110.

Nottingham Island

Nottingham Island Series

A series of marine shell samples from Nottingham Island, District of Franklin, Northwest Territories, were collected and submitted by C.A. Laymon.

GSC-4152. Nottingham Island (I) 5780 ± 80
$\delta^{13}C = +1.7‰$

The marine shells (sample CL/84/NO/M105; 26.2 g dry weight; *Hiatella arctica*; identified by C.A. Laymon), enclosed in sandy gravel, from about 2 km east of an abandoned weather station on southern Nottingham Island (63°7'N, 77°54'W), at an elevation of 10 m, were collected

in September of 1984. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2430 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 5760 ± 80.

Comment (C.A. Laymon): This date is on shells from a sublittoral sandy gravel deposit, which appears to have been modified by sea ice and tidal currents. Based on the relative sea level curve for Nottingham, Salisbury, and Mill Islands in western Hudson Strait, it is interpreted that these molluscs were living at a depth of at least 25 m and, therefore, do not provide good relative sea level control.

GSC-4162. Nottingham Island (II) 6940 ± 90
$\delta^{13}C = +1.0‰$

The marine shells (whole valves) (sample CL/84/NO/M84; 27.9 g dry weight; *Hiatella arctica*; identified by C.A. Laymon), enclosed in sand, from southern Nottingham Island, approximately 4 km from the west coast (63°11.5'N, 78°2'W), at an elevation of 57 m, were collected in August, 1984. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6920 ± 90.

Comment (C.A. Laymon): This date is on shells from a sandy littoral/sublittoral deposit between 48 and 64 m a.h.t. Shells were used for development of a relative sea level curve for western Hudson Strait.

GSC-3991. Nottingham Island (III) 7200 ± 80
$\delta^{13}C = -24.4‰$

The wood (sample CL/84/NO/W3; 11.6 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 84-53)), enclosed in coarse to fine sand, from 5.5 km east of the west coast of Nottingham Island in the central region of the island (63°19'N, 78°9'W), at an elevation of 100 m, was collected in September, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7180 ± 80.

Comment (C.A. Laymon): The trunk of a small tree and a few sticks were collected from an ice contact, regressive sequence. A 4 m thick unit of coarse to fine sand overlies 1.5 m of interbedded sand and clayey silt, which is in turn underlain by more than 6 m of massive sublittoral clayey silt. The wood was collected from the base of the upper sand unit. The age and elevation of this sample corresponds closely with that of a shell sample (GSC-4038) from northeastern Nottingham Island. This wood date is used in constructing a relative sea level curve for the large islands in western Hudson Strait and provides a minimum age for seasonally ice-free conditions around these islands.

GSC-4038. Nottingham Island (IV) 7350 ± 90
$\delta^{13}C = +0.9‰$

The marine shells (sample CL/84/NO/M91; 26.6 g dry weight; *Hiatella arctica*; identified by C.A. Laymon), enclosed in mud (mud boils), from northeastern Nottingham Island (63°26'N, 77°55'W), at an elevation of 100 m, were collected in August, 1984. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2570 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7340 ± 90.

Comment (C.A. Laymon): This date is used to construct a relative sea level curve for western Hudson Strait and to establish the age of the earliest postglacial occurrence of marine molluscs on Nottingham Island. This shell sample is the highest found on the island although other sheltered sites with substrate seemingly suitable for mollusc habitation do occur at higher elevations (marine limit 170-185 m a.h.t.). The age and elevation of this sample closely corresponds to that of driftwood (GSC-3991) found on the west side of Nottingham Island. Based on the depositional setting of the driftwood and the relative sea level curve for Nottingham, Salisbury, and Mill islands, the molluscs from this site are interpreted to have been living a water depth of less than 25 m.

Prescott Island

Prescott Island Series

A series of wood samples from Prescott Island, District of Franklin, Northwest Territories, were collected and submitted by A.S. Dyke.

GSC-4447. Prescott Island (I) 70 ± 50
$\delta^{13}C = -23.8‰$

The wood, driftwood (sample 86 DCA 531; 17.5 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-50)), from a surface collection on gravel, 1 km inland on southwest Prescott Island (72°58'N, 97°2'W), at an elevation of 32 m, was collected on August 6, 1986. The sample was treated with hot base, hot acid (slightly calcareous), and distilled water rinses. The age estimate is based on two counts for 3900 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 50 ± 50.

Comment (A.S. Dyke): The sample came from a dry, sound "log" measuring 40 x 5 cm on the surface of raised beach gravel. The result indicates that modern wood has been carried to 32 m elevation by humans and confirms that some risk is involved in dating "surface" driftwood (see also GSC-4457). The age also confirms, however, that boreal driftwood spends very little time in transit across or around Arctic Ocean from its place of origin to place of stranding in Arctic Archipelago.

GSC-4457. Prescott Island (II) 560 ± 60
$\delta^{13}C$= -24.7‰

The wood, driftwood (sample 86 DCA 553; 11.5 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-52)), enclosed in gravel, from 0.5 km inland, northwest Prescott Island (73°7'N, 97°0'W), at an elevation of 12.5 m, was collected on August 8, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 550 ± 60.

Comment (A.S. Dyke): The sample came from a dry, sound "log" measuring 30 x 10 x 8 cm on the surface of raised beach gravel. Elevation is based on two altimeter measurements with 3 minutes between collection site and sea level readings. An age of about 3.0 ka was expected for this sample based on other driftwood ages available from Prescott and Prince of Wales islands. The much younger than expected age indicates that the wood has been moved by humans, a problem which effects some small proportion of driftwood that is not actually embedded in the raised beach material (two other samples).

GSC-4458. Prescott Island (III) 1380 ± 60
$\delta^{13}C$= -23.8‰

The wood, driftwood (sample 86 DCA 565; 11.0 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-53)), from a surface collection on raised beach gravel, from the west side of a bay on northeast Prescott Island (73°8'N, 96°42'W), at an elevation of 8.0 m, was collected on August 9, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2180 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 1360 ± 60.

Comment (A.S. Dyke): The sample came from a dry, sound piece of "log" measuring 50 x 6 x 3 cm on the surface of raised beach gravel. Elevation is based on two identical altimeter measurements with 1.5 minutes between collection site and sea level readings. Sample elevation is higher by about 2 m than would be expected from the age, which possibly indicates slight sea ice push of the sample above its contemporary sea level. See Prescott Island emergence curve in Dyke et al., 1991.

GSC-4583. Prescott Island (IV) 3510 ± 70
$\delta^{13}C$= -22.1‰

The wood, driftwood (sample 86 DCA 564; 10.8 g dry weight; *Pinus resinosa/sylvestris*; identified by H. Jetté (unpublished GSC Wood Report No. 87-42)), enclosed in gravel, from northeast Prescott Island (73°9'N, 96°43'W), at an elevation of 11.0 m, was collected on August 9, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 3470 ± 70.

Comment (A.S. Dyke): The wood was sampled from a splintered log 60 x 5 x 5 cm, partly embedded in raised beach gravel. The wood was dry and sound at the time of collection and all surface wood and wood along cracks was removed prior to dating. Elevation is based on two altimeter measurements with 1.5 minutes between sample site and sea level readings. The age, although slightly older than expected, is a reasonable approximation of the age of the 11 m beach.

GSC-4456. Prescott Island (V) 5070 ± 90
$\delta^{13}C$= -23.8‰

The wood, driftwood (sample 86 DCA 554; 27.0 g dry weight; *Larix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-51)), enclosed in raised beach sand, from 1 km inland on northwest Prescott Island (73°7'N, 97°4'W), at an elevation of 23.5 m, was collected on August 8, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2470 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 5050 ± 90.

Comment (A.S. Dyke): The sample came from a splintered log embedded in raised beach sand. Wood and enclosing material were saturated with water at time of collection. Wood was soft, very easily cut, and had a distinct purple discoloration throughout, which lessened, though was not eliminated, upon oven drying. The sample is 200-300 years younger than expected based on other dated wood from this elevation range and particularly GSC-4459 (Prescott Island series). This could be due to minor sea ice shoving of the wood at time of or before burial or to very slight contamination of the sample as possibly indicated by the discoloration. Elevation is based on two altimeter measurements with 4 minutes between collection site and sea level readings. See Prescott Island emergence curve in Dyke et al., 1991.

GSC-4459. Prescott Island (VI) 5300 ± 80
$\delta^{13}C$= -25.5‰

The wood, driftwood (sample 86 DCA 561; 11.4 g dry weight; *Larix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-54)), from a surface collection on sand, 2 km inland on northeast Prescott Island (73°9'N, 96°44'W), at an elevation of 21.0-21.5 m, was collected on August 9, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2610 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 5300 ± 80.

Comment (A.S. Dyke): The sample came from an extensively splintered log, part of which was still embedded in sand between two gravel beach ridges. The wood was dry and sound at time of collection. Elevation was determined by two measurements with surveying altimeter with 6 minutes between collection site and sea level readings. The age is a reasonable one for a local relative sea level of 21.0-21.5 m (Dyke et al., 1991).

GSC-4524. Prescott Island (VII) 6960 ± 110
$\delta^{13}C$= +2.9‰

The marine shells (sample 86 DCA 572; 28.2 g dry weight; *Hiatella arctica*; identified by A.S. Dyke), enclosed in sand, from western Prescott Island (73°3′N, 97°6′W), at an elevation of approximately 20 m, were collected on August 11, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 6910 ± 110.

Comment (A.S. Dyke): The sampled shells consisted exclusively of paired valves of *Hiatella arctica*, *Mya truncata*, and *Astarte borealis*, none apparently in life position. The shells, which are about 90% *Hiatella*, occur in a clean streamcut face in foreset sand beds of a delta along with minor marine algae and terrestrial plant detritus. The sands terminate upward at horizontal gravel beds at 28.5-29.0 m a.s.l. The overlying gravel is thought to be a beach deposit rather than delta topset beds. A bench at 36.5 m may represent the original delta level during deposition of the foreset sands. The age estimate is a reasonable one for a 36.5 m relative sea level as it is accordant with the ages of shells at 65 m (8650 ± 120 BP, GSC-4515) and driftwood at 21 m (5300 ± 80 BP, GSC-4459) from nearby sites.

GSC-4523. Prescott Island (VIII)
uncorrected 8310 ± 120

The marine shells (sample 86 DCA 571; 31.6 g dry weight; *Mya truncata*; identified by A.S. Dyke), enclosed in stony mud, from 1 km inland on western Prescott Island (73°3′N, 97°6′W), at an elevation of 44-46 m, were collected on August 11, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2490 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

Comment (A.S. Dyke): The shells were collected from an old colluviated streamcut face in stony mud underlying a prominent, gravel veneered terrace at 49 m a.s.l. The deposit is rich in shells of *Mya truncata* (dominant), *Hiatella arctica* (subdominant), *Clinocardium ciliatum*, and *Astarte borealis* (both common). Many of these surface shells are partly encrusted with secondary calcite. Six valves of *Mya* with very little encrustation were cleaned by cavitron prior to submission to the laboratory. The age of the shells indicates that they grew before relative sea level fell to the 49 m level and that the 49 m terrace is erosional.

GSC-4515. Prescott Island (IX) 8650 ± 120
$\delta^{13}C$= +2.3‰

The marine shells (sample 86 DCA 527; 42.0 g dry weight; *Mya truncata*; identified by A.S. Dyke), from a surface collection on sand and gravel, western Prescott Island (73°1.5′N, 97°3.5′W), at an elevation of 65 m, were collected on August 5, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2210 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8610 ± 120.

Comment (A.S. Dyke): The shells were collected from an eroded, unvegetated, delta terrace remnant. This 65 m level is distinct and occurs on several valley spurs. Molluscs at the site include *Hiatella arctica*, *Mya truncata*, *Astarte borealis*, and *Clinocardium ciliatum*. Minor secondary calcite was removed from the *Mya* valves prior to submission to the laboratory for dating. The radiocarbon date is a reasonable estimate of the age of a local 65 m relative sea level. It closely corroborates an age of 8565 ± 125 BP (S-2835) on a Bowhead whale bone in a beach at 66 m on neighbouring Pandora Island (Morris, 1988). Marine limit on Prescott Island is 107 m, and the oldest postglacial material recovered from the island is a Bowhead whale earbone at 57.5 m with an age estimate of 9335 ± 145 BP (S-2913). Sample elevation of GSC-4515 is based on a single measurement with a surveying altimeter with 13 minutes between sample site and sea level.

Prince of Wales Island

GSC-3996. Transition Bay 8940 ± 130
$\delta^{13}C$= +1.1‰

The marine shells (*Mya truncata*; identified by A.S. Dyke) were enclosed in marine silt. Sample 84-DCA-196 S was collected by T.F. Morris on August 11, 1984 from 1 km north of the mouth of Transition Bay, 2 km west of Peel Sound, Prince of Wales Island, District of Franklin, Northwest Territories (72°5′30″N, 96°33′W), at an elevation of 115.5 m; submitted by T.F. Morris.

The sample (10.9 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.97.

The uncorrected age is 8930 ± 130.

Comment (T.F. Morris): The site is an elevated, unvegetated body of marine silt. Whole, single valves were collected. Shells were found down to 25 cm below the surface. The collection site lies close to local marine limit, but deglaciation probably occurred slightly earlier as indicated by this date because shells from a site about 30 km to the west (up ice) dated 9190 ± 170 BP (GSC-4049), and whale bone from another site farther west dated 9225 ± 215 BP (S-2597), although the standard errors of these three dates overlap.

GSC-4442. Peel Sound 9100 ± 90
$\delta^{13}C$= +1.0‰

The marine shells (*Mya truncata*; identified by A.S. Dyke) were enclosed in stony mud. Sample 86 DCA 568 was collected by A.S. Dyke on August 9, 1986 from 2.1 km inland from the head of the large bay on northeast Prescott Island, Peel Sound, Prince of Wales Island, District of Franklin, Northwest Territories (73°6.5′N, 96°48′W), at an elevation of approximately 107 m; submitted by A.S. Dyke.

The sample (48.9 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9080 ± 90.

Comment (A.S. Dyke): The sample consisted of 35 whole valves of *Mya* with partial periostracum cover, minor iron staining, and possibly small patches of thin secondary calcite crusts on some valves. Most of the abundant shells at the site have extensive secondary calcite encrustation. The only other species present at the site is *Hiatella arctica*. Elevation is approximate because a long time elapsed (50 minutes) between altimeter readings at the collection site and at sea level.

The shells came from stony mud, which is overlain by about 1 m of topset gravel marking the top of a small delta thought to be an ice contact feature recording local marine limit. The age is about 200 years younger than expected, based on a marine limit age of 9470 ± 100 BP (GSC-3679) from a site on the north side of Browne Bay just west of Prescott Island (Dyke, 1987). The result possibly indicates slightly delayed deglaciation of Prescott Island by a remnant local ice cap although the geomorphological evidence of such a feature is not strong. Alternatively, contamination by calcite has reduced the age by two centuries or so (Dyke et al., 1991).

Coningham Bay Series

A series of wood samples from 18 km southwest of Coningham Bay, southeast corner of Prince of Wales Island, District of Franklin, Northwest Territories, were collected by T.F. Morris on August 18, 1984; submitted by T.F. Morris.

GSC-3985. Coningham Bay (I) 6100 ± 80
$\delta^{13}C$= -23.1‰

The wood, driftwood (sample 84-DCA-209 W; 10.9 g dry weight; *Larix*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-50)), enclosed in beach gravels, (71°39′40″N, 97°21′W), at an elevation of 31.5 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2540 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6070 ± 80.

Comment (T.F. Morris): A ≥5 m long log was found embedded in a well defined beach. The wood could not be excavated completely as it was frozen in place. Depth to permafrost was 34 cm and 3.30 m of the entire log was exposed. At the base, 34 cm of beach material covered the log. The driftwood was aligned almost parallel to the orientation of the raised beaches. The sample provides a reasonable date on the 31.5 m relative sea level.

GSC-3967. Coningham Bay (II) 6910 ± 80
$\delta^{13}C$= -25.8‰

The wood, driftwood (sample 84-DCA-210 W; 11.1 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-45)), enclosed in beach gravel, (71°39′40″N, 97°22′W), at an elevation of 39 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2390 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6930 ± 80.

Comment (T.F. Morris): A log 21 m long was found well embedded in a well defined beach but was not frozen in place. The driftwood was aligned almost parallel to the orientation of the raised beaches. This dated site provides a point on an emergence curve for southeastern Prince of Wales Island.

GSC-4049. Fisher Lake 9190 ± 170
$\delta^{13}C$= +1.9‰

The marine shells (*Hiatella arctica*; identified by A.S. Dyke) were enclosed in glacial marine silts. Sample 84 DCA 89 S was collected by T.F. Morris on July 27, 1984 from 12 km west of the end of Fisher Lake, just north of an unnamed lake, Prince of Wales Island, District of Franklin, Northwest Territories (72°13′40″N, 97°31′W), at an elevation of 97.0 m; submitted by T.F. Morris.

The sample (7.7 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two count for 2510 minutes (two 1 day) in the 2 L counter with a mixing ratio of 2.79.

The uncorrected age is 9160 ± 170.

Comment (T.F. Morris): This corrected age provides a minimum date indicating when glacier ice retreated from east-central Prince of Wales Island. Ice retreat was to the southwest. This sample also provides a marine limit date.

GSC-4258. Cape Hardy 9280 ± 90
$\delta^{13}C$= +0.2‰

The marine shells (*Hiatella arctica*; identified by A.S. Dyke) were enclosed in stony mud. Sample 85 DCA 319 was collected by A.S. Dyke on July 8, 1985 from 10 km south-southwest of Cape Hardy, Prince of Wales Island, District of Franklin, Northwest Territories (73°49′N, 97°32.5′W), at an elevation of approximately 20 m; submitted by A.S. Dyke.

The sample (46.1 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9270 ± 90.

Comment (A.S. Dyke): The sample, mostly paired valves of juvenile *Hiatella arctica*, was collected from a stony glaciomarine mud overlying till and was overlain by postglacial marine mud and by alluvium. The high stone content of the mud implied ice proximal sedimentation. However, other dates from this vicinity indicate that local deglaciation occurred about 9.7-9.8 ka (S-2710, 9845 ± 150 BP on shells from marine limit within a few kilometres of the site; GSC-3954, 9660 ± 90 BP on shells from glaciomarine sediment on the adjacent shore of Baring Channel: Dyke, 1987, Dyke et al., 1991). The stony fossiliferous sediment dated by GSC-4250 possibly represents local deposition from ice bergs. Sediment also contained a few *Mya truncata* and well preserved fragile *Portlandia arctica*.

Browne Bay Series

A series of marine shell and detrital organics samples from the east bank of the largest river on the outer north shore of Browne Bay, 1 km from the coast, Prince of Wales Island, District of Franklin, Northwest Territories (73°18.5'N, 97°42'W), were collected and submitted by A.S. Dyke.

GSC-4045. Browne Bay (I) 2920 ± 60
uncorrected

The organic detrital plant material (sample 84 DCA 903; 38.8 g wet weight), enclosed in sand, at an elevation of 5.5 m, was collected on August 24, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2120 minutes (two 5 day) in the 5 L counter with a mixing ratio of 1.00.

Comment (A.S. Dyke): A 3 m section extending to 7.5 m above sea level was comprised of 1 m of horizontally bedded greenish-grey, fine sand with orange lenses and blue-black lenses and beds of smelly organic material as well as a few red sand beds overlain by 2 m of horizontally bedded, foreset laminated red sand with a single layer of greenish-grey, fine sand near the top. The uppermost red sand is a shelly beach sediment (cf. GSC-4031). The lower multicoloured sands are interpreted as intertidal to shallow subtidal flat sediments. GSC-4045 is from a single 2 cm thick bed of organics just below the beach sand. The sample provides a reasonable maximum date on a 7.5 m relative sea level. See Browne Bay emergence curve (Dyke et al., 1991).

GSC-4031. Browne Bay (II) 3760 ± 80
$\delta^{13}C = +1.7‰$

The marine shells (sample 84 DCA 904; 15.0 g dry weight; *Astarte borealis*; identified by A.S. Dyke), enclosed in sand, at an elevation of 7.5 m, were collected on September 21, 1984. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.47.

The uncorrected age is 3740 ± 80.

Comment (A.S. Dyke): This sample is from the red beach sand at the same section as GSC-4045. The beach sediment overlies organic detritus dated at 2920 ± 60 BP and hence must be younger than that. The shells were mostly whole valves, most with intact periostracum, some articulated. The sample illustrates that even very well preserved shells from beach sediment do not provide good dates on the enclosing sediment. See Browne Bay emergence curve in Dyke et al., 1991.

GSC-3989. Guillemard Bay 4400 ± 70
$\delta^{13}C = -23.7‰$

The wood, driftwood (*Larix*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-52)) was enclosed in beach gravels. Sample 84-DCA-75 W was collected by T.F. Morris on July 25, 1984 from the mouth of Guillemard Bay, Prince of Wales Island, District of Franklin, Northwest Territories (71°41'N, 98°8'W), at an elevation of 16 m; submitted by T.F. Morris.

The sample (11.2 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2460 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4380 ± 70.

Comment (T.F. Morris): A log 265.0 cm long was buried in dry, unvegetated beach material; 113 cm of the log was exposed. The sample provides a reasonable age on a 16 m relative sea level (Morris, 1988).

Arabella Bay Series

A series of marine shell samples from the Arabella Bay area, Prince of Wales Island, District of Franklin, Northwest Territories were collected and submitted by A.S. Dyke.

GSC-4227. Arabella Bay (I) 4490 ± 70
$\delta^{13}C = +1.6‰$

The marine shell (sample 85 DCA 425; 47.0 g dry weight; *Astarte borealis*; identified by A.S. Dyke), enclosed in silt/clay, from the west side of Arabella Bay, (73°43.5'N, 99°17'W), at an elevation of 15-17 m, was collected on July 27, 1985. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4460 ± 70.

Comment (A.S. Dyke): The shells were collected from horizontally bedded silt and clay just below the gravel terrace of an extensive estuarine delta at 19.5 m. Most shells had

extensive or complete periostracum and many were paired with connecting ligaments still intact. The date is a reasonable estimate of the age of the 19.5 m relative sea level; see curve in Dyke et al., 1991. The sample also includes *Mya truncata*, *Hiatella arctica*, and two unidentified gastropods.

GSC-4241. Arabella Bay (II) 6570 ± 80
$\delta^{13}C$= -1.1‰

The marine shell (sample 85 DCA 392; 42.4 g dry weight; *Serripes groenlandicus*; identified by A.S. Dyke), enclosed in sand/silt, from the mouth of a stream flowing into southwest Arm of Arabella Bay (73°42′N, 99°15′W), at an elevation of 8-10 m, was collected on July 21, 1985. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2040 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 6590 ± 80.

Comments (A.S. Dyke): Shells were collected from horizontally bedded sand and silt underlying an extensive raised delta terrace at 13 m a.s.l. Most shells had nearly complete periostracum. The age is much too old to relate to the 13 m sea level position (Dyke et al., 1991), as shown by GSC-4227. The sample also includes *Portlandia arctica Astarte borealis*, *Mya truncata*, and *Hiatella arctica*.

Smith Bay Series

A series of wood samples from the Smith Bay area, northwestern Prince of Wales Island, District of Franklin, Northwest Territories were collected and submitted by A.S. Dyke.

GSC-4412. Smith Bay (I) 130 ± 70
$\delta^{13}C$= -23.4‰

The wood, driftwood (sample 86 DCA 500; 10.3 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-46)), lying on gravel, from the north shore of Smith Bay, 7.5 km from the head of the bay, 0.5 km inland (73°14′N, 99°59′W), at an elevation of 32 m, was collected on July 29, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2130 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 110 ± 70.

Comment (A.S. Dyke): This piece of driftwood (50 x 5 x 2 cm) was the highest of a series of driftwood samples collected from the Smith Bay area. It was hoped that the sample would provide a date on a 32 m relative sea level position, but the age indicates that the wood has been moved to the site by humans. This is always a potential problem when dealing with wood that is not embedded in raised marine sediment nevertheless, most surface samples provide reliable results, as shown by other dates in this series.

GSC-4428. Smith Bay (II) 2350 ± 60
$\delta^{13}C$= -25.8‰

The wood, driftwood (sample 86 DCA 511; 10.6 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-49)), enclosed in gravel, from the south shore of Smith Bay, 7.2 km from the head of the bay, 0.5 km inland (73°11′N, 99°59′W), at an elevation of 10 m, was collected on August 30, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 2640 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 2370 ± 60.

Comment (A.S. Dyke): The sample was collected from several pieces of dry, splintered wood, (largest 1.5 m x 50 cm x 20 cm) lying on the surface of dry, unvegetated raised beach gravel. It provides a reasonable age for a local 10 m relative sea level and, along with GSC-4417 and -4427, helps define the emergence history of the Smith Bay area over the last 6.0 ka. Elevation is based on two altimeter measurements with 3 minutes between sample site and sea level readings.

GSC-4427. Smith Bay (III) 4020 ± 70
$\delta^{13}C$= -23.8‰

The wood, driftwood (sample 86 DCA 510; 14.8 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-48)), enclosed in gravel, from the south shore of Smith Bay, 6.2 km from the head of the bay, 0.5 km inland (73°12′N, 99°57′W), at an elevation of 15 m, was collected on July 30, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2110 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4000 ± 70.

Comment (A.S. Dyke): The sample consisted of a small "log" 30 x 4 x 3 cm lying on the surface of dry, unvegetated beach gravel. It provides a reasonable age on a local 15 m relative sea level and, along with GSC-4417 and -4428, helps define the emergence history of the Smith Bay area over the last 6.0 ka. Elevation is based on two altimeter measurements with 3.5 minutes between sample site and sea level readings.

GSC-4417. Smith Bay (IV) 5910 ± 80
$\delta^{13}C$= -25.5‰

The wood, driftwood (sample 86-DCA-512; 12.5 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-47)), enclosed in gravel, from the south shore of Smith Bay, 8 km from the head of the bay, 0.5 km inland (73°11.5′N, 100°2′W), at an elevation of 25.5 m, was collected on July 30, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2050 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5920 ± 80.

Comment (A.S. Dyke): The sample was collected from a splintered log 15 cm in diameter at the tip protruding from the unvegetated gravel of a raised beach ridge. It provides a reasonable age on a local 25.5 m relative sea level, and taken together with GSC-4427 and -4428, provides good dating control on the emergence of the Smith Bay area over the last 6.0 ka. At 10 100 ± 100 BP (GSC-4408) the sea stood more than 104 m above its present level. The elevation of GSC-4417 is based on two altimeter measurements with 5 minutes between sample site and sea level readings.

GSC-4525. Smith Bay (V) 8640 ± 110
$\delta^{13}C = +3.9‰$

The marine shells (sample 86 DCA 478; 29.6 g dry weight; *Hiatella arctica*; identified by A.S. Dyke), enclosed in stony clay (glaciomarine), from 10.8 km east-southeast of head of Smith Bay (73°10.5′N, 99°27′W), at an elevation of approximately 40 m, were collected on July 27, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8580 ± 110.

Comment (A.S. Dyke): The rationale for dating these shells was the same as for GSC-4528. The shells were collected from the surface of an extensive stony clay, which has a morainal morphology in places, including large kettle depressions. Shells are abundant on the surface in only a few places, and they consist mostly of whole valves, some unusually thick. It was thought that the state of preservation indicated that the shells had been brought to the surface by frost action and that they would date glaciomarine sediment deposition. The age estimate, however, shows that these shells likely colonized an older clay substrate about 1.0 ka after local deglaciation. The minimum date of local deglaciation is provided by an age estimate of 9440 ± 135 BP (S-2912; Dyke et al., 1991) on Bowhead whale earbones from a nearby site at 70 m a.s.l.

Reliance Bay Series

A series of marine shell samples from the Reliance Bay area, Prince of Wales Island, District of Franklin, Northwest Territories were collected and submitted by A.S. Dyke.

GSC-3975. Reliance Bay (I) 8410 ± 140
$\delta^{13}C = +3.5‰$

The marine shell (sample 84 DCA 766; 13.0 g wet weight; *Mya truncata*; identified by A. Aitken), enclosed in stony clay, from 6 km east of Drake Bay (73°36′N, 100°22′W), at an elevation of approximately 45 m, was collected on July 31, 1984. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2530 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.75.

The uncorrected age is 8360 ± 140.

Comment (A.S. Dyke): The sample was taken from the surface and backwall of recent retrogressive thaw-flowslide. *Mya truncata* was dominant, *Hiatella arctica* was common, *Macoma calcarea* less common, with a single *Balanus* sp. present. These were all identified by A. Aitken, Department of Fisheries and Oceans. The flowslide has developed in a 4 m thick, very stony, crudely stratified glaciomarine sediment, which overlies 8 m of till sitting on bedrock. Shells are very abundant in the slumped debris and are scattered throughout the entire thickness of the glaciomarine sediment. Very few shells are present on the surface (undisturbed) of the deposit. The glaciomarine sediment is so stony that it could easily be mistaken for till. The site lies 1 km in front of a large end moraine ridge. This ridge is part of a system of bulky end moraines that cross the land between Drake Bay and Baring Channel. Correlative moraines occur on the opposite side of Drake Bay (Mount Clarendon is part of it), and these are in turn probably correlative with the Rawlinson Hills End Moraine system on the opposite side of Ommanney Bay. Marine limit on the distal side of the moraines at Donnett Hill is 188 m. At one site on the proximal side marine limit is 144 m. It was hoped that this sample would date glaciomarine sedimentation while ice stood at the nearby end moraine. However, the moraine formed approximately 2.0 ka earlier (Dyke, 1987).

GSC-4033. Reliance Bay (II) 8970 ± 90
$\delta^{13}C = +0.6‰$

The marine shells (sample 84 DCA 746; 35.2 g dry weight; *Hiatella arctica*; identified by A.S. Dyke), enclosed in sand and gravel, from 2 km south of a large salt water lake on the south side of Reliance Bay (73°43′N, 100°0′W), at an elevation of 59.5 m, were collected on July 27, 1984. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2100 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8960 ± 90.

Comment (A.S. Dyke): These shells were collected from horizontally bedded, fine gravel underlying a small delta terrace remnant, the highest of a series of such terraces. All shells were stained with iron or had thin films of encrusting material. The sample provides a minimum age on a 59.5 m relative sea level. The collection is dominantly *Hiatella arctica* but also includes *Mya truncata*, *Astarte* sp., and *Balanus* sp. Elevation is based on a single measurement with a surveying altimeter. See Arabella Bay emergence curve in Dyke et al., 1991.

Drake Bay Series

A series of marine shell samples from the Drake Bay area, northwest Prince of Wales Island, District of Franklin, Northwest Territories, were collected and submitted by A.S. Dyke.

GSC-4527. Drake Bay (I) 9350 ± 110
$\delta^{13}C$= +0.2‰

The marine shells (sample 86 DCA 432; 40.6 g dry weight; *Mya truncata* and *Hiatella arctica*; identified by A.S. Dyke), from a surface collection on gravel, from 3.1 km southwest of the head of Drake Bay (73°23′N, 100°29′W), at an elevation of 96 m, were collected on July 17, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9350 ± 110.

Comment (A.S. Dyke): These shells were collected from the surface of raised beach gravel developed on a small esker and are the highest shells recovered from northwest Prince of Wales Island, other than from glaciomarine sediment. Three samples from higher elevation glaciomarine sediment are S-2708, shells from stony clay at 133 m below a marine limit shoreline at 188 m at Donnett Hill dated 11 005 ± 170 BP (Dyke, 1987); S-2708, shells from stony clay at 120 m just below an ice contact marine limit delta lip at 133 m at Arabella Bay dated 10 435 ± 160 BP (Dyke, 1987); and GSC-4408 shells from stony clay at 104 m south of outer Drake Bay dated 10 100 ± 100 BP. The beach gravel surface at the site of GSC-4527 is shell-rich but all shells are fragmented and many have secondary calcite crust. The sample submitted to the laboratory was cleaned with a cavitron to remove calcite prior to leaching. The elevation determination is based on a single measurement with a surveying altimeter with 13 minutes between the site and the datum.

GSC-4408. Drake Bay (II) 10 100 ± 110
$\delta^{13}C$= +0.0‰

The marine shells (sample 86 DCA 446; 42.2 g dry weight; *Mya truncata*; identified by A.S. Dyke), enclosed in stony clay, from 2.5 km west of Mount Clarendon, 7.5 km southwest of Drake Bay (73°27.5′N, 100°54′W), at an elevation of approximately 104 m, were collected on July 20, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 100 ± 110.

Comment (A.S. Dyke): The shells were collected from weakly fossiliferous glaciomarine stony clay, deposited in a large kettle depression in the Mount Clarendon End Moraine System. They are the highest shells found on this part of the island, and they provide a minimum date on withdrawal of ice from the moraine system and a maximum date on a 104 m relative sea level. The Mount Clarendon End Moraine System includes deposits representing a number of ice frontal positions but is broadly correlative with the Rawlinson Hills and Donnett Hill morainal systems to the southwest and northeast respectively. GSC-4408 is thus compatible with other dates on the morainal belt of northwestern Prince of Wales Island: S-2709 (10 435 ± 160 BP), minimum date on youngest ridge of the Donnett Hill End Moraine System; S-2708 (11 005 ± 170 BP), minimum date on an older ridge of the Donnett Hill End Moraine System; and S-2683 (10 070 ± 150 BP), minimum date on the youngest ridge of the Rawlinson Hills End Moraine System. These dates are discussed by Dyke (1987).

Hollist Point Series

A series of wood samples from the Hollist Point / Point Gell area, northwest Prince of Wales Island, District of Franklin, Northwest Territories were collected and submitted by A.S. Dyke.

GSC-3977. Hollist Point (I) 920 ± 60
$\delta^{13}C$= -25.3‰

The wood, driftwood (sample 84 DCA 705; 11.3 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-37)), enclosed in till, from 5 km south-southeast of Hollist Point (72°52′N, 101°30′W), at an elevation of 2.0-2.3 m, was collected on July 15, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2320 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 920 ± 60.

Comment (A.S. Dyke): The sample was taken from a 1.5 m long driftwood log resting on the surface of a wave washed till 100 m inland of the present high tide lines. Elevation is based on two measurements using a surveying altimeter with 3 minutes between site and sea level readings.

GSC-3945. Hollist Point (II) 1060 ± 50
$\delta^{13}C$= -25.8‰

The wood, driftwood (sample 84 DCA 703; 11.6 g dry weight; *Larix*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-38)), enclosed in till, from 3 km south of Hollist Point, (72°53′N, 101°33′W), at an elevation of 3.5-4.0 m, was collected on July 15, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 1070 ± 50.

Comment (A.S. Dyke): The sample was collected from a 1 m long driftwood log 80% buried in cryoturbated till at the base of a shingle beach ridge. The sample was 45 m inland of the present high tide line and separated from the modern beach by three raised beach ridges. Driftwood is very abundant along the west coast of Ommanney Bay between the modern beach and 4 m elevation but is rare above 4 m. This sample dates the timing of initial "abundant" wood penetration to the area and provides a reasonable age on the 4 m relative sea level. Elevation was determined by a surveying altimeter with 3 minutes between the site and sea level readings on two determinations.

GSC-3962. Hollist Point (III) 3660 ± 60
$\delta^{13}C$= -24.8‰

The wood, driftwood (sample 84 DCA 707; 11.8 g dry weight; *Larix*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-40)), enclosed in gravel, from 7 km south of Hollist Point (72°51′N, 101°33′W), at an elevation of 12 m, was collected on July 15, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2430 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3650 ± 60.

Comment (A.S. Dyke): The sample was taken from a 1 m long, well preserved driftwood log resting on the surface of an unvegetated raised beach comprised of platy limestone material. A vertebra of a Bowhead whale at the same elevation at a nearby site dated 4155 ± 100 BP (S-2589; Dyke et al., 1991). Elevation is based on two identical measurements with a surveying altimeter, with 5 minutes between sample site and sea level readings.

GSC-4025. Hollist Point (IV) 8220 ± 80
$\delta^{13}C$= +1.7‰

The marine shells (sample 84 DCA 716; 40.2 g dry weight; *Hiatella arctica*; identified by A.S. Dyke), enclosed in silt and sand, from 2.5 km southwest of Point Gell (73°5′N, 101°58′W), at an elevation of 38.0 m, were collected on July 18, 1984. The sample was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8190 ± 80.

Comment (A.S. Dyke): These shells were collected from the surface and backwall of a fresh flowslide developed in a small deposit of horizontally bedded fine sand and silt containing striated dropstones ranging up to boulder size. The sediment was interpreted as an ice proximal glaciomarine deposit laid down at time of local deglaciation. The age of these shells suggests that the deposit was laid down about 2.0 ka after local deglaciation. Elevation is based on two measurements with a surveying altimeter with 10 minutes between sample site and sea level readings.

GSC-3936. Hollist Point (V) 8230 ± 110
$\delta^{13}C$= -23.9‰

The wood, driftwood (sample 84 DCA 717; 11.9 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 84-39)), enclosed in gravel, from 4 km south of Point Gell (73°2′N, 101°54′W), at an elevation of 58.5 m, was collected on July 18, 1984. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8210 ± 110.

Comment (A.S. Dyke): This sample was broken from a 2 m long driftwood log lying on the surface of a coarse, thin shingle beach comprised of limestone fragments. The beach surface is mostly unvegetated; the log is the highest driftwood found in the vicinity of Point Gell / Hollist Point on the Ommanney Bay coast of northwest Prince of Wales Island. This date helps control the upper part of an emergence curve and provides a very reasonable age on the 58.5 m relative sea level. Part of a Bowhead whale skeleton occurs on beach gravel 100 m away from and 0.5 m lower than the log. A rib from this animal dated 8875 ± 135 BP (S-2588). Elevation was determined by a surveying altimeter with 10 minutes between readings at sample site and sea level (high tide).

Cape Richard Collinson Series

A series of marine shell and wood samples from the Cape Richard Collinson area, northwestern Prince of Wales Island, District of Franklin, Northwest Territories were collected and submitted by A.S. Dyke.

GSC-4398. Cape Richard Collinson (I) 1400 ± 50
$\delta^{13}C$= -26.2‰

The wood, driftwood (sample 86 DCA 403; 13.9 g dry weight; *Larix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-45)), enclosed in gravel, from 17 km north-northeast of Cape Richard Collinson, 100 m inland (72°54.5′N, 102°38′W), at an elevation of 5 m, was collected on July 7, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2110 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 1420 ± 50.

Comment (A.S. Dyke): The sample was collected from a dry, sound log of 20 cm diameter embedded in a gravel raised beach in nearly horizontal position with about 1 m of its tip exposed. Elevation is determined by two measurements with surveying altimeter with a lapse of 2 minutes between sample site and datum; both measurements were identical. The date provides a reasonable estimate of the age of a 5 m relative sea level. It agrees with other dates from the Cape Richard Collinson area and from nearby Hollist Point (Dyke et al., 1991.

GSC-4478. Cape Richard Collinson (II) 1860 ± 70
$\delta^{13}C$= -24.5‰

The wood, driftwood (sample 86 DCA 400; 9.7 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 87-21)), from a surface collection on gravel, from 13.7 km north-northwest of Cape Richard Collinson (72°53′N, 102°37′W), at an elevation of 6.5-7.0 m, was collected on July 7, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 1850 ± 70.

Comment (A.S. Dyke): The sample came from an "L" shaped piece of driftwood, about 40 cm long on each limb, resting on the surface of platy raised beach gravel. Elevation is determined by two measurements with surveying altimeter with 2.5 minutes between readings at sample and sea level. The wood was dry and sound, bleached on top but not on the underside, which indicates that it had rested on the gravel for a long time without being moved. All surface wood and wood along cracks was removed prior to dating. The age is entirely compatible with its elevation, and especially with an age of 1400 ± 50 BP (GSC-4398) on wood embedded in beach gravel at 5 m from a site nearby.

GSC-4387. Cape Richard Collinson (III) — 4070 ± 60; $\delta^{13}C$ = -22.5‰

The wood, driftwood (sample 86 DCA 418; 9.7 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-44)), from a surface collection on a gravel beach, from 17.5 km north-northeast of Cape Richard Collinson, 1.2 km inland (72°55′N, 102°37′W), at an elevation of 17-17.5 m, was collected on July 12, 1986. The sample was treated with hot base, hot acid, and distilled water rinses. The age estimate is based on two counts for 2280 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4030 ± 60.

Comment (A.S. Dyke): The sample was collected from a 1.5 m long dry sound log lying on the surface of unvegetated raised beach gravel. Reported elevation range (17.0-17.5 m) results from two measurements with surveying altimeter with 9 minutes between site and datum. The date provides a reasonable estimate on the age of the local 17 m relative sea level and agrees with other dates from the area (Dyke et al., 1991).

GSC-4479. Cape Richard Collinson (IV) — 4630 ± 60; $\delta^{13}C$ = -23.2‰

The wood, driftwood (sample 86 DCA 410; 11.8 g dry weight; *Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 87-22)), from a surface collection on gravel, from 20.5 km north-northeast of Cape Richard Collinson, 1.9 km inland (72°57′N, 102°32′W), at an elevation of 22.0 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4600 ± 60.

Comment (A.S. Dyke): This sample is a few centuries younger than expected, based on the age of several other wood samples from the area, which yielded accordant ages, and is likely some 2-3 m above its contemporary sea level position, perhaps due to push by sea ice, a highly active process on this coast. This piece of driftwood weighed about 500 g at time of collection and was dry and sound. Surface wood and wood along cracks was removed prior to dating. Elevation is based on two altimeter measurements with 6.5 minutes between sample site and sea level readings. See Cape Richard Collinson emergence curve in Dyke et al., 1991.

GSC-4361. Cape Richard Collinson (V) — 5270 ± 70; $\delta^{13}C$ = -23.2‰

The wood, driftwood (sample 86 DCA 408; 11.1 g dry weight; *Larix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-36)), from a surface collection on till, from 15.3 km north-northeast of Cape Richard Collinson, 1.5 km inland (72°53′N, 102°33′W), at an elevation of 23.5-24.5 m, was collected on July 9, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2570 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 5240 ± 70.

Comment (A.S. Dyke): Two pieces of driftwood occurred at this site, the largest 1.5 m long and 10 cm diameter. The outside surface was cut off and wood along cracks removed prior to dating. The date provides a reasonable age on the local 24 m relative sea level (Dyke et al., 1991). Elevation was measured twice by surveying altimeter with 10 and 8 minutes between site and datum resulting in measurements of 23.5 and 24.5 m. Driftwood is very rare on this part of Prince of Wales Island above 24 m elevation so this date also records the onset of more abundant driftwood penetration to this part of the Arctic Archipelago (Dyke and Morris, 1990).

GSC-4343. Cape Richard Collinson (VI) — 8680 ± 90; $\delta^{13}C$ = -23.4‰

The wood, driftwood (sample 86 DCA 428; 27.3 wet weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 86-35)), enclosed in silt, from 17.5 km north-northeast of Cape Richard Collinson, 3 km inland (72°54′N, 102°34′W), at an elevation of 59 m, was collected on July 15, 1986. The sample was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2250 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8650 ± 90.

Comment (A.S. Dyke): The wood was water-saturated at time of collection and much of it was poorly preserved. The soundest pieces were collected, dirty and algae-covered parts were cut away in the field. The wood was shipped wet and was oven-dried in Ottawa.

Numerous pieces of wood, apparently from a single original log, occurred at this site and protruded from marine silt on a moderate slope. The wood and enclosing sediment have probably soliflucted downslope somewhat since stranding of the wood so the date pertains to a relative sea level of 59 m or more. This sample and two others (S-2720, 8660 ± 395 BP and S-2702, 8695 ± 130 BP) record the earliest documented penetration of driftwood to Prince of Wales

Island during the postglacial period (Dyke and Morris, 1990). See also Cape Richard Collinson emergence curve in Dyke et al., 1991.

GSC-4528. Cape Richard Collinson (VII) — 8920 ± 120; $\delta^{13}C = +2.6‰$

The marine shell (sample 86 DCA 411; 32.3 g dry weight; *Mya truncata* and *Hiatella arctica*; identified by A.S. Dyke), enclosed in stony clay, from 13 km northeast of Cape Richard Collinson (72°52′N, 102°31′W), at an elevation of 33.5 m, was collected on July 10, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2590 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8880 ± 120.

Comment (A.S. Dyke): The shells were collected from the surface of a small deposit of stony clay on the distal side of the oldest ridge in the Rawlinson Hills End Moraine System. Because shells are not present on the surface of the adjacent till, it was hoped that the shells might provide an age on the deposition of the stony clay, likely a glaciomarine deposit laid down when the ice front stood nearby. However, the site lies down ice of four other neighbouring sites that have yielded older age estimates: marine shells from one site yielded an age estimate of 10 070 ± 150 BP (S-2683, Dyke, 1987); Bowhead whale bones from three other sites yielded ages of 9605 ± 140 BP (S-2590, Dyke, 1987), 10 005 ± 120 BP (S-2916), and 10 000 ± 145 BP (S-2922). Hence, either the shells (GSC-4528) grew on the surface of the stony clay much after deposition, or deposition of stony clays in this area continued for at least 1.0 ka after local deglaciation.

GSC-4322. Cape Richard Collinson (VIII) — 39 400 ± 1900; $\delta^{13}C = +1.4‰$

The marine shell (sample 86 DCA 415; 38.0 g dry weight; *Hiatella arctica*; identified by A.S. Dyke), enclosed in stony clay, from 12 km northeast of Cape Richard Collinson, 7.5 km inland (72°55′N, 102°25′W), at an elevation of approximately 107 m, was collected on July 12, 1986. The sample was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2410 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 39 300 ± 1900.

Comment (A.S. Dyke): All shells collected from this poorly fossiliferous deposit were fragmented but were not obviously abraded; fragmentation appeared to result from frost action rather than transport. Shells came from a stony clay, similar to glaciomarine sediment, which is widespread on this part of Prince of Wales Island, situated between two ridges of the Rawlinson Hills End Moraine System, on the side of a large kettle lake. The older of the two ridges is the most prominent and longest ridge in the moraine system. Shells were the highest recovered from this part of Prince of Wales Island, where local marine limit lies at about 137 m.

It was hoped that the shells would provide a minimum date on local deglaciation and local marine limit, but it seems more likely, in light of the age, that the shells are glacial erratics either redeposited in Late Wisconsinan glaciomarine sediment or contained within a large erratic mass of pre-Late Wisconsinan glaciomarine sediment that constitutes part of the end moraine system. Erratic shells have been collected from till at several sites on the island.

A minimum date on the moraine system is provided by S-2685 (10 070 ± 150 BP, Dyke et al., in press) on shells from glaciomarine sediment from a site at 70 m a.s.l. several kilometres to the southeast (Dyke, 1987). Taken at face value, GSC-4322 indicates ice free conditions during the Middle Wisconsinan, but the conservative interpretation would be to regard the age as a minimum as the quoted age is at the limit of the technique.

Stefansson Island

GSC-4377. Stefansson Island northeast — 9640 ± 110; $\delta^{13}C = +2.0‰$

The marine pelecypod shells (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in silt. Sample HCA-86-1-8-4 was collected by D.A. Hodgson on August 1, 1986 from northeast Stefansson Island, District of Franklin, Northwest Territories (73°35′N, 104°40′W), at an elevation of 75 m; submitted by D.A. Hodgson.

The sample (28.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2300 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9600 ± 110.

GSC-4336. Stefansson Island east — 9560 ± 100; $\delta^{13}C = +0.7‰$

The marine shells, valves and fragments (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in silt. Sample HCA-86-30-7-2A was collected by D.A. Hodgson on July 30, 1986 from 7 km from the east coast of Stefansson Island, District of Franklin, Northwest Territories (73°28′N, 104°43′W), at an elevation of 110-120 m; submitted by D.A. Hodgson.

The sample (28.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 4180 minutes (two 2 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9550 ± 100.

Victoria Island

GSC-4313. Mount Pelly 8020 ± 80
$\delta^{13}C = +1.3‰$

The marine pelecypod shells (*Hiatella arctica*; identified by D.R. Sharpe) were enclosed in sand. Sample 84-SBB-0513 was collected by W. Sheldrick on July 6, 1984 from Mount Pelly, 12 km northeast of Cambridge Bay, Victoria Island, District of Franklin, Northwest Territories (69°10′N, 104°43′W), at an elevation of 157 m; submitted by D.R. Sharpe.

The sample (39.6 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4150 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8000 ± 80.

GSC-4069. Ekalluk River 8330 ± 90
$\delta^{13}C = +0.5‰$

The marine pelecypod shells (*Clinocardium ciliatum*; identified by W. Blake, Jr.) were enclosed in marine deltaic fine sand and silt 3-4 m below the surface. Sample 84-SSB-61 was collected by D.R. Sharpe and W. Sheldrick on July 13, 1984 from Ekalluk River where it empties into Ekalluk Lake, 50 km north of Cambridge Bay, Victoria Island, District of Franklin, Northwest Territories (69°53′N, 104°54′W), at an elevation of 95 m; submitted by D.R. Sharpe.

The sample (46.3 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8320 ± 90.

Comment (D.R. Sharpe): The sample occurred as an in situ collection of paired valves found in a delta or fan. If it is a delta, the date relates to a water plane of 95 m that is 50-60 m below the local marine limit. If it is a fan, the date represents a minimum estimate on deglaciation.

Comment (W. Blake, Jr.): The sample consisted of two intact pairs of *Clinocardium ciliatum*. Both pairs (one valve of each was cracked, but still intact) retained internal lustre. There was no chalkiness and external ornamentation was excellent. The larger was 7.1 cm wide and 6.2 cm high (this pair had some ligaments intact). The smaller was 6.0 cm wide and 5.0 cm high. Shells were greater than 1 mm in thickness for the most part.

GSC-4242. Washburn Lake 8120 ± 90
$\delta^{13}C = +2.4‰$

The marine pelecypod shells (*Hiatella arctica*; identified by D.R. Sharpe) were from a surface collection on sand. Sample 85 SBB 0470 was collected by D.R. Sharpe and R. Kelly on July 23, 1985 from 70 km east of Washburn Lake, eastern Victoria Island, District of Franklin, Northwest Territories (70°6′N, 104°56′W), at an elevation of 132 m; submitted by D.R. Sharpe.

The sample (42.6 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8080 ± 90.

GSC-4127. Ekalluk River Area 8420 ± 130
$\delta^{13}C = +0.6‰$

The marine shells (*Hiatella arctica*; identified by W. Blake, Jr.) were enclosed in sand or from a surface collection. Sample 84-SBB-46 was collected by D.R. Sharpe and P.A. Egginton on July 13, 1984 from 2 km south of Ekalluk River, 50 km north of Cambridge Bay, Victoria Island, District of Franklin, Northwest Territories (69°52′N, 104°57′W), at an elevation of 136 m; submitted by D.R. Sharpe.

The sample (11.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.91.

The uncorrected age is 8410 ± 130.

Comment (D.R. Sharpe): This sample was collected close to a local marine limit of about 150 m a.s.l. and represents a sample that may best approximate a minimum date for local deglaciation in southeastern Victoria Island. The fact that it is a near-surface and surface collection renders it a poor collection (see below) and therefore requires some caution in final interpretation. The date is considered to be reasonable despite the possibility of contamination. It is younger than a wood date at 113 m, 25 km to the south of GSC-266 (8640 ± 140 BP, Fyles, 1963).

Comment (W. Blake, Jr.): In general, the shells in this collection were in poor condition. There was no periostracum and nearly all were encrusted (orange brown or gray), pitted (holes), stained various colours, or had "dots" of lichens or algae. The sample submitted included five intact right valves and one fragment, nine intact left valves and three fragments with the largest 3.4 x 1.6 cm and the smallest 2.2 x 1.2 cm. A few shells were clean and one valve showed internal lustre.

GSC-4299. Ekalluk River South 8440 ± 100
$\delta^{13}C = +1.8‰$

The marine pelecypod shells (*Hiatella arctica*; identified by D.R. Sharpe) were enclosed in sand. Sample 85-SBB-0478 was collected by D.R. Sharpe and R. Kelly on July 25, 1985 from 13 km southwest of Ekalluk Lake where Ekalluk River drains from its south end, Victoria Island, District of Franklin, Northwest Territories (69°49′N, 105°23′W), at an elevation of 116 m; submitted by D.R. Sharpe.

The sample (28.2 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8410 ± 100.

Cambridge Bay Series

A series of detrital organics samples from 6 km south of Cambridge Bay, Victoria Island, District of Franklin, Northwest Territories (69°7'N, 105°7'W), were collected by P.A. Egginton on July 11, 1984; submitted by P.A. Egginton.

GSC-4338. Cambridge Bay (I) 2000 ± 60
$\delta^{13}C$= -28.0‰

The detrital organics (sample 84 EK 0003; 370.0 g wet weight), mixed with marine silts, at an elevation of approximately 15 m, were treated with hot acid (slightly calcareous), and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2600 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 2050 ± 60.

GSC-4331. Cambridge Bay (II) 2590 ± 60
$\delta^{13}C$= -32.3‰

The detrital organics (sample 84 EK 0005; 690.0 g wet weight), mixed with marine silts, at an elevation of approximately 30 m, were treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2930 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 2710 ± 60.

Comments (P.A. Egginton): Five pits were dug at 20 m intervals along an 80 m solifluction slope. At or near the base of the active layer (80 cm) a continuous organic layer was encountered in each of the five 1 m long pits. If the organic layer is interpreted as being continuous along this transect then GSC-4338 and -4331 presumably date burial of the surface organics at the bottom and top of this 80 m slope segment, respectively. This suggests an average rate of movement of the order of 13 cm/a. This interpretation is valid only in the absence of 'young' secondary solifluction sheets in the upper segments of the slope.

GSC-4254. Cambridge Bay 4920 ± 100
$\delta^{13}C$= +1.1‰

The marine pelecypod shells (*Mya truncata*; identified by D.R. Sharpe) were enclosed in sand. Sample 84-SBB-0007 was collected by D.R. Sharpe and W. Sheldrick on July 5, 1984 from 7 km west of Cambridge Bay, Victoria Island, District of Franklin, Northwest Territories (69°6'N, 105°16'W), at an elevation of 30 m; submitted by D.R. Sharpe.

The sample (32.6 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2360 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4900 ± 100.

GSC-4234. Cambridge Bay area 8740 ± 100
$\delta^{13}C$= +0.5‰

The marine shells (*Hiatella arctica*; identified by D.R. Sharpe) were enclosed in sand. Sample 85-SBB-0484 was collected by D.R. Sharpe and R. Kelly on July 26, 1985 from 70 km northwest of Cambridge Bay, eastern Victoria Island, District of Franklin, Northwest Territories (69°39'N, 105°55'W), at an elevation of 130 m; submitted by D.R. Sharpe.

The sample (49.5 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8730 ± 100.

GSC-4316. Storkerson Peninsula 9340 ± 100
$\delta^{13}C$= +1.2‰

The marine shells, paired whole valves (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in silt. Sample HCA-86-24-7-4 was collected by D.A. Hodgson on July 24, 1986 from northwest Storkerson Peninsula, Victoria Island, District of Franklin, Northwest Territories (72°53'N, 106°10.2'W), at an elevation of 70-80 m; submitted by D.A. Hodgson.

The sample (40.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2670 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9320 ± 100.

GSC-4294. Surrey River 7630 ± 110
$\delta^{13}C$= +1.9‰

The marine pelecypod shells (*Mya truncata*; identified by D.R. Sharpe) were enclosed in pebbly sand and thin diamicton. Sample 84 SBB 0212 was collected by D.R. Sharpe and W. Sheldrick on July 28, 1984 from 8 km along Surrey River (towards Surrey Lake) from Wellington Bay, Dease Strait, Victoria Island, District of Franklin, Northwest Territories (69°30'N, 106°48'W), at an elevation of 65 m; submitted by D.R. Sharpe.

The sample (37.3 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4320 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7600 ± 110.

GSC-4262. Surrey Lake River 7500 ± 130
$\delta^{13}C = +1.4‰$

The marine shells (*Hiatella arctica*; identified by D.R. Sharpe) were enclosed in pebbly sand and silt. Sample 84-SBB-0126 was collected by D.R. Sharpe and W. Sheldrick on July 25, 1984 from Surrey Lake River, 55 km northwest of Cambridge Bay, Victoria Island, District of Franklin, Northwest Territories (69°28′N, 106°52′W), at an elevation of 43 m; submitted by D.R. Sharpe.

The sample (68.1 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on two counts for 2330 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7480 ± 130.

GSC-4269. Surrey Lake 8660 ± 130
$\delta^{13}C = +1.1‰$

The marine shells (*Mya truncata*; identified by D.R. Sharpe) were enclosed in silty clay. Sample 84-SBB-0201 was collected by D.R. Sharpe on July 27, 1984 from southeast shore of Surrey Lake, 30 km northwest of Wellington Bay, Victoria Island, District of Franklin, Northwest Territories (69°37′N, 107°9′W), at an elevation of 50 m; submitted by D.R. Sharpe.

The sample (57.2 g dry weight) was treated with an acid leach to remove the outer 30% of the sample. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8650 ± 130.

GSC-4287. Wellington Bay area 8680 ± 100
$\delta^{13}C = +0.7‰$

The marine shells (*Mya truncata*; identified by D.R. Sharpe) were from a surface collection. Sample 84-SBB-0209 was collected by D.R. Sharpe on July 28, 1986 from small thaw lake 13 km northwest of Wellington Bay, Victoria Island, District of Franklin, Northwest Territories (69°34′N, 106°52′W), at an elevation of 100 m; submitted by D.R. Sharpe.

The sample (25.8 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 5760 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8670 ± 100.

GSC-4296. Byron Bay area 820 ± 80
$\delta^{13}C = +1.7‰$

The marine pelecypod shells (*Macoma*; identified by D.R. Sharpe) were enclosed in sand. Sample 84-SBB-0016 was collected by D.R. Sharpe and W. Sheldrick on July 8, 1984 from 30 km east of Byron Bay on the north shore of Dease Strait, Victoria Island, District of Franklin, Northwest Territories (68°57′30″N, 107°48′W), at an elevation of 1 m; submitted by D.R. Sharpe.

The sample (42.2 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2450 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 790 ± 80.

GSC-4851. Lauchlan River area 9310 ± 100
$\delta^{13}C = +1.7‰$

The marine shells (*Mya truncata*; identified by D.R. Sharpe) were from a surface collection on fine sand and silt boils. Sample 84-SBB-144 was collected by D.R. Sharpe, W. Sheldrick, and L. Ho on July 26, 1984 from north of Lauchlan River about 40 km north of Byron Bay, south central Victoria Island, District of Franklin, Northwest Territories (69°6′N, 108°54′W), at an elevation of 156 m; submitted by D.R. Sharpe.

The sample (15.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 5580 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.34.

The uncorrected age is 9280 ± 100.

Comment (D.R. Sharpe): This site appears to provide a minimum date of removal of ice from Dease Strait and Coronation Gulf where marine limit occurs at about 165 m a.s.l. on the south-central coast of Wollaston Peninsula. A higher and earlier lacustrine water plane appears north of this site at 180-200 m a.s.l. This date compares with GSC-255, dated at 9540 ± 150 BP, on marine shells collected by J.G. Fyles at 152 m a.s.l. (cf. Sharpe, 1990).

Comment (W. Blake, Jr.): Most of the shells in the sample submitted were encrusted. The sample sent to the laboratory was one whole valve (but with a hole in it) and six fragments; all showed the truncated end typical of *Mya truncata*. The whole valve was 4.5 x 3.3 cm in size. All shells were greater than 1 mm thick in places.

GSC-4356. Hadley Bay area 10 300 ± 90
$\delta^{13}C = -0.4‰$

The marine pelecypod shells (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in reddish silt. Sample HCA 86-8-7-6A was collected by D.A. Hodgson on July 8, 1986 from 20 km west of southwest Hadley Bay, Victoria Island, District of Franklin, Northwest Territories (72°8′N, 109°6.5′W), at an elevation of 190 m; submitted by D.A. Hodgson.

The sample (47.8 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 3770 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 90.

GSC-3677. North Shore 3200 ± 60
$\delta^{13}C$= -25.8‰

The wood, driftwood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-19)) was from a surface collection on a cobble beach. Sample HCA-82-3/7-1 C was collected by D.A. Hodgson and J. Bednarski on July 3, 1982 from the north shore of Victoria Island, District of Franklin, Northwest Territories (72°58.5'N, 109°57.0'W), at an elevation of 7.0 m; submitted by D.A. Hodgson.

The sample (11.9 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water. The age estimate is based on two counts for 2090 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 3220 ± 60.

Burns Lake Series

A series of moss/sedge peat and wood samples from 45 km south of Burns Lake, central Victoria Island, District of Franklin, Northwest Territories (70°58.5'N, 110°4.0'W), at an elevation of 220 m, were collected by D.A. Hodgson and J. Bednarski on July 31, 1982; submitted by D.A. Hodgson.

GSC-4206. Burns Lake (I) 4730 ± 80
$\delta^{13}C$= -29.5‰

The peat moss (sample HCA-82-31-7-13C; 30.0 g dry weight), enclosed in lacustrine silt, was treated with hot base, hot acid (noncalcareous), distilled water rinses. The age estimate is based on two counts for 2060 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 4800 ± 80.

GSC-4193. Burns Lake (II) 9120 ± 100
$\delta^{13}C$= -27.6‰

The moss, sedge peat (sample HCA-82-31-7-13 A/2; 30.0 g dry weight), enclosed in lacustrine silt, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one counts for 3360 minutes (one 2 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9160 ± 100.

GSC-4202. Burns Lake (III) 9180 ± 100
$\delta^{13}C$= -29.2‰

The wood, a single twig broken in pieces (sample HCA-82-31-7-13D; 11.2 g dry weight; *Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 86-3)), enclosed in lacustrine silt, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9250 ± 100.

GSC-3777. Kilian Lake 10 200 ± 130
$\delta^{13}C$= +3.2‰

The marine shells (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in sand. Sample HCA-83-20-7-4 was collected by D.A. Hodgson on July 20, 1983 from 4.5 km northeast of northeast tip of Kilian Lake, Victoria Island, District of Franklin, Northwest Territories (72°14'N, 111°33'W), at an elevation of 65.0 m; submitted by D.A. Hodgson.

The sample (12.5 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.75.

The uncorrected age is 10 100 ± 130.

GSC-3801. Prince Albert Sound 10 300 ± 100
$\delta^{13}C$= -0.03‰

The marine pelecypod shells (*Hiatella arctica*; identified by D.A. Hodgson) were enclosed in surface of silty stones (washed till). Sample HCA-82-19/6-3 was collected by D.A. Hodgson and J. Bednarski on June 19, 1982, 10 km inland from the north shore, at the east end of Prince Albert Sound, Victoria Island, District of Franklin, Northwest Territories (70°37.5'N, 112°18'W), at an elevation of 106 m; submitted by D.A. Hodgson.

The sample (27.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4260 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 300 ± 100.

GSC-4134. Read Island Area 9320 ± 170
$\delta^{13}C$= +1.8‰

The marine mollusc shells (*Mya truncata*; identified by W. Blake, Jr.) were from a surface collection on a drumlin. Sample SBB-82-S9143 was collected by D.R. Sharpe and M. Nixon on July 24, 1982, 60 km east-southeast of Read Island, southwest Victoria Island, District of Franklin, Northwest Territories (69°4'N, 112°27'W), at an elevation of 93 m; submitted by D.R. Sharpe.

The sample (8.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.72.

The uncorrected age is 9290 ± 170.

Comment (D.R. Sharpe): This date provides a minimum estimate for deglaciation in a poorly dated portion of southern Victoria Island (Sharpe, 1990). The sample is from 93 m a.s.l. in an area where local marine limit is about 140 m a.s.l. The date appears to be young for marine limit when compared to a date at 152 m a.s.l. about 100 km east-northeast of this site (GSC-255; 9540 ± 150 BP, Dyck, et al., 1965) and hence

the date more closely approximates the age of the marine stand close to 93 m a.s.l. The shells were poorly preserved and therefore may be subject to contamination.

Comment (W. Blake, *Jr.*): This sample was very poorly preserved - most shells were encrusted with a brown layer internally and externally. The five fragments dated included truncated ends of *Mya truncata*. These fragments had some encrustation removed by scraping. The largest fragment was 3.3 x 2.5 cm. There was no lustre and no periostracum.

GSC-4114. Forsyth Bay area 7660 ± 70
$\delta^{13}C$= +0.2‰

The marine shells (*Mya truncata*; identified by D.R. Sharpe) were enclosed in stony sand. Sample 83-NJ-0002 was collected by M. Nixon on July 12, 1983 from east of Forsyth Bay, Wollaston Peninsula, Victoria Island, District of Franklin, Northwest Territories (69°10.75'N, 113°17.25'DW), at an elevation of 40 m; submitted by D.R. Sharpe.

The sample (34.1 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7660 ± 70.

Comment (D.R. Sharpe): The sample dates the formation of a beach ridge at 40 m and this marine water plane on southern Wollaston. This can be compared with older marine terracing at this elevation from northern Wollaston Peninsula (Sharpe, 1990).

Comment (W. Blake, *Jr.*): The sample submitted consisted of six intact pairs; the smallest 3.9 x 2.5 cm; the largest 4.5 x 2.8 cm. One right and two left valves were intact. All valves had traces of periostracum, some chalkiness, and a little internal lustre. No encrustations appeared on these five pairs but other shells were encrusted.

GSC-4168. Read Island area 8800 ± 130
$\delta^{13}C$= +1.9‰

The marine shells (*Mya truncata*; identified by W. Blake, Jr.) were from a surface collection. Sample SBB-82-SH75 was collected by D.R. Sharpe and F.M. Nixon on July 26, 1982 from 20 km northwest of Read Island on Victoria Island, District of Franklin, Northwest Territories (69°20'N, 114°19'W), at an elevation of 33 m; submitted by D.R. Sharpe.

The sample (9.6 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.32.

The uncorrected age is 8770 ± 130.

Comment (D.R. Sharpe): This sample dates a water plane somewhere between marine limit of about 140-145 m and the elevation of the sample at 33 m. It dates closer to the 140 m level (possibly 100 m) but comparison with an emergence curve from Point Caen will be necessary (Sharpe, 1990).

Cape Back Series

A series of marine shell samples from approximately 61 km east-northeast of Cape Back, on the north coast of Wollaston Peninsula, Victoria Island, District of Franklin, Northwest Territories (70°16'N, 115°12'W), at an elevation of 77 m, were collected by D.R. Sharpe and F.M. Nixon on July 24, 1982; submitted by D.R. Sharpe.

GSC-4011. Cape Back (I) 9240 ± 150
$\delta^{13}C$= +1.7‰

The marine pelecypod shells (sample SBB-82-SH37; 23.0 g dry weight; *Hiatella arctica*; identified by D.R. Sharpe), from a surface collection on marine silt and till, were not pretreated. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 9210 ± 150.

GSC-4011 2. Cape Back (II) 10 200 ± 280
$\delta^{13}C$= +2.5‰

A replicate of the marine shells (sample SBB-82-SH37; 7.0 g dry weight; *Hiatella arctica*; identified by D.R. Sharpe) were treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on two counts for 2190 minutes (two 1 day) in the 2 L counter with a mixing ratio of 3.35.

The uncorrected age is 10 200 ± 280.

Comments (D.R. Sharpe): The shells likely relate to the local marine limit on this washed upland that was measured at 111 m south of the site (Sharpe, 1990). The shells probably migrated downslope to a lower site or lived in deeper water. Sample GSC-4011 was not acid leached. Sample GSC-4011 2 was acid leached and presumably this explains the age difference.

Comments (W. Blake, *Jr.*): These shells (largest 4.2 x 1.9 cm) were badly encrusted (thick brown encrustations, some covering one whole side of the shell). There were also some light grey coatings in places. The shells had no lustre and no periostracum. The sample consisted of 9 whole shells and 13 fragments, all of which were in extremely poor condition.

All the shells used were fragments - almost the entire sample (both those judged 'marginal' and those judged 'acceptable') was characterized by encrustations, but the fragments submitted were not. No periostracum and no lustre were present; some shells exhibited staining or translucence; some shell fragments were pitted or spalled.

GSC-4293. Wollaston Peninsula north 10 400 ± 120
$\delta^{13}C$= +1.9‰

The marine shells (*Hiatella arctica*?; identified by D.R. Sharpe) were enclosed in surface of marine silt. Sample 83-NJ-0038 was collected by C. Borowiecki and M. Nixon on July 28, 1983 from the north coast of Wollaston Peninsula, Victoria Island, District of Franklin, Northwest Territories (70°13′N, 115°44′30″W), at an elevation of 71 m; submitted by D.R. Sharpe.

The sample (27.2 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4320 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 400 ± 120.

GSC-3725. Cape Back 8980 ± 80
$\delta^{13}C$= -0.9‰

The marine pelecypod shell fragments (*Mytilus edulis*; identified by D.R. Sharpe) were from a surface collection on stony sand and pebbly sand. Sample 83-NJ-0035 was collected by M. Nixon on July 27, 1983, from above a large constructional beach ridge on the north coast of Wollaston Peninsula, Victoria Island, District of Franklin, Northwest Territories (70°11′40″N, 116°9′W), at an elevation of 47 m; submitted by D.R. Sharpe.

The sample (47.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 8990 ± 80.

Comment (D.R. Sharpe): The shells included some paired valves and they occurred along the strike of the strand but not in large numbers above or below this level. Therefore, the sample is considered to date closer to the 47 m elevation rather than local marine limit at about 120 m a.s.l. Thus the date appears to record a marine water plane somewhat below marine limit when ice was removed from Victoria Island. The date helps define the pattern of postglacial emergence on the north coast of Wollaston Peninsula at Cape Back (Sharpe, 1990).

Comment (W. Blake, Jr.): Only the bag containing the largest fragments was used, and most of the fragments were without the inner nacreous layer. The blue shells were clean and well preserved; all fragments were less than 3.0 cm in length.

GSC-3719. Cape Back 1150 ± 60
$\delta^{13}C$= -24.7‰

The wood (*Picea*; identified by R.J. Mott (unpublished GSC Wood Report No. 83-44)) was overlain by 5 cm of gravel in a beach ridge exposure. Sample 83-NJ-6040 was collected by M. Nixon on July 29, 1983, from a river cut, on the north coast of Wollaston Peninsula, 40 km east of Cape Back, Victoria Island, District of Franklin, Northwest Territories (70°12′30″N, 116°9′30″W), at an elevation of 4 m; submitted by D.R. Sharpe.

The sample (11.5 g dry weight) was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2220 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 1140 ± 60.

Comment (D.R. Sharpe): The date provides a maximum estimate of the formation of beach ridges at 4 m a.s.l. The sample was emplaced by wave action rather than ice shove because there was no physical disturbance of the strata. There is a good series of undisturbed beach berms above the sample and these extend to sea level (Sharpe, 1990).

Comment (W. Blake, Jr.): The length of the log submitted was 35 cm and was 11.5-12.0 cm in diameter. Wood splintered parallel to growth rings as well as across. Eleven to twelve rings were used from outermost wood; all outside wood and wood along fractures was cut off.

Point Caen Series

A series of wood and shell samples from 8 km northwest of Point Caen, on Dolphin and Union Strait, Wollaston Peninsula, Victoria Island, District of Franklin, Northwest Territories (69°21′N, 116°10′W), was collected by M. Nixon and T. Holden between July 1 and 5, 1987; submitted by D.R. Sharpe.

GSC-4648. Point Caen (I) 460 ± 50
$\delta^{13}C$= -25.3‰

The wood (sample 87 NJ-7f; 13 g dry weight; *Picea*; identified by H. Jetté (unpublished GSC Wood Report No. 88-15)), collected on the surface at an elevation of 27 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2340 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 460 ± 50.

GSC-4504. Point Caen (II) 740 ± 50
$\delta^{13}C$= -23.4‰

The wood (sample 87 NJ-15f; 20.9 g dry weight; *Larix*; identified by H. Jetté (unpublished GSC Wood Report No. 87-41)), enclosed in gravel, at an elevation of 3 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2480 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 720 ± 50.

GSC-4616. Point Caen (III) 8870 ± 100
$\delta^{13}C = +1.9‰$

The marine shells (sample 87 NJ-12f; 27.0 g dry weight; *Hiatella arctica, Mya truncata, Macoma*; identified by D.R. Sharpe), enclosed in sand and pebbles, at an elevation of 36 m, were treated with an acid leach to remove the outer 15% of the sample. The age estimate is based on two counts for 2360 minutes in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 8840 ± 100.

GSC-4537. Point Caen (IV) 9280 ± 80
$\delta^{13}C = +1.1‰$

The marine shells (sample 87 NJ-11f; 41.0 g dry weight; *Mya truncata, Hiatella arctica, Mytilus, Macoma, Mya arenaria*), enclosed in sand, at an elevation of 46 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9260 ± 80.

GSC-4622. Point Caen (V) 9360 ± 110
$\delta^{13}C = -28.9‰$

The wood (sample 87 NJ-18f; 12.9 g dry weight; *Salix*; identified by H. Jetté (unpublished GSC Wood Report No. 88-14)), enclosed in frozen diamicton, at an elevation of 75 m, was treated with hot base, hot acid (noncalcareous), and distilled water rinses. The age estimate is based on two counts for 2360 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9420 ± 110.

Additional marine shell samples were collected from 1 km north of the river mouth, 5 km north-northwest of Point Caen (69°21′N, 116°2′W).

GSC-4579. Point Caen (VI) 7440 ± 90
$\delta^{13}C = +2.1‰$

The marine shells (sample 87 NJ-26f; 46.9 g dry weight; *Mya truncata* mainly *M. arenaria, Macoma*; identified by D.R. Sharpe), enclosed in silt, at an elevation of 15 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 2230 minutes (two 1 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7410 ± 90.

GSC-4519. Point Caen (VII) 9380 ± 120
$\delta^{13}C = +1.9‰$

The marine shells (sample 87 NJ-2f; 42.2 g dry weight; *Mya truncata*; identified by D.R. Sharpe and M. Nixon), enclosed in sand, at an elevation of 69 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 5760 minutes (one 4 day) in the 2 L counter with a mixing ratio of 1.45.

The uncorrected age is 9350 ± 120.

An additional marine shell sample was collected from 7 km northwest of Point Caen (69°21′N, 116°7′W).

GSC-4608. Point Caen (VIII) 9020 ± 80
$\delta^{13}C = +1.4‰$

The marine shells (sample 87 NJ-10f; 29.1 g dry weight; *Mya arenaria, Macoma, Hiatella, Mytilus*; identified by M. Nixon), enclosed in sand and washed till, at an elevation of 56 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 5640 minutes in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9000 ± 80.

Comment (D.R. Sharpe): The significance of these samples is best assessed as part of this series. The dates indicate a good estimate for these elevations (in situ) and deglaciation, showing establishment of marine limit at 100 m, was underway at 10.0 ka.

GSC-388. Prince Albert Sound area >32 400

The tundra plant material was enclosed in stratified silt (6 m) underlain by till and overlain by till and glacial gravel. Sample FG-59-102a was collected by J.G. Fyles on July 31, 1959 from a river bank about 8 km north of Prince Albert Sound, Victoria Island, District of Franklin, Northwest Territories (70°38′N, 116°35′W); submitted by J.G. Fyles.

The sample (82.8 g dry weight) was treated with acid and distilled water rinses; base treatment was omitted. The age estimate is based on two (1 day) counts in the 2 L counter with a mixing ratio of 1.27.

Comment (J.G. Fyles): The dated material is believed to record an interstadial interval. Deposits enclosing dated material are of local extent but may correlate with similar materials (which so far have yielded no organic remains) that lie beneath till throughout large parts of northwest Victoria Island and northeast coast of Banks Island (Walton et al., 1961, p. 52).

Cape Baring Series

A series of marine shell samples from Cape Baring area, Wollaston Peninsula, Victoria Island, District of Franklin, Northwest Territories, were collected by D.R. Sharpe and F.M. Nixon on July 26, 1982; submitted by D.R. Sharpe.

GSC-4203. Cape Baring (I) 10 600 ± 90
$\delta^{13}C = +0.2‰$

The marine shell (sample SBB-82-SH50; 45.3 g dry weight; *Hiatella arctica*; identified by D.R. Sharpe), from a surface collection, from 3 km southeast of Cape Baring

(70°2'N, 117°17'W), at an elevation of 80 m, was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 10 600 ± 90.

Comment (D.R. Sharpe): This date corroborates two other dates: GSC-3566 (Sharpe, 1984; McNeely, 1989) and GSC-3727. All three dates appear to date marine limit at about 115 m a.s.l. and provide our best minimum estimate for deglaciation of northwest Wollaston Peninsula (cf. Sharpe, 1984, 1988). Shells in this collection were 'in total' not well preserved yet they provide consistent results.

Comment (W. Blake, Jr.): Shells in this collection were poorly preserved. All showed spalling of exterior layers, discoloration, pitting, and some encrustation. Some were translucent. The sample submitted consisted of nine left valves and eleven right valves, the largest 4.4 x 2.4 cm and the smallest 3.4 x 2.2 cm.

GSC-3727. Cape Baring (II) — 10 600 ± 100; $\delta^{13}C$= -0.3‰

The marine pelecypod shells (sample SBB-82-SH56; 26.5 g dry weight; *Hiatella arctica*; identified by D.R. Sharpe), from a surface collection on marine silt, from about 12 km south-southeast of Cape Baring (69°55'N, 117°9'W), at an elevation of 105 m, were treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on one count for 4200 minutes (one 3 day) in the counter with a mixing ratio of 1.00.

The uncorrected age is 10 600 ± 100.

Comment (D.R. Sharpe): The sample is related to a nearby marine limit of 120 m and thus the date provides a minimum age for marine incursion following deglaciation of full ice cover of Wollaston Peninsula (Sharpe, 1984). This date confirms GSC-3566 (Sharpe, 1984; McNeely, 1989) dated at 10.7 ka and it is also related to marine limit and deglaciation of Wollaston Peninsula.

Comment (W. Blake, Jr.): The sample consisted of two partial right valves (both broken to get rid of encrusted part), as well as five whole left valves and three fragments. The largest valves (broken ends) were greater than 4.7 cm long, with a maximum height of 2.5 cm. Most shells were 1 mm or less in thickness, except near the hinge where they were 2-3 cm. No periostracum or ligament was present on the shells and a few still retained internal lustre. There was minor staining, no wear, and some translucence.

GSC-3678. Minto Inlet — 9630 ± 90; $\delta^{13}C$= +1.3‰

The marine shells (*Mytilus edulis*; identified by W. Blake, Jr.) were enclosed in marine sands with gravel. Sample VH-82-029 was collected by J-S. Vincent on June 28, 1982 from 6.5 km southwest of Cape Wollaston, Minto Inlet, Diamond Jenness Peninsula, Victoria Island, District of Franklin, Northwest Territories (71°4.5'N, 118°11'W), at an elevation of 13 m; submitted by J-S. Vincent.

The sample (38.1 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4020 minutes (one 3 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 9610 ± 90.

Comment (J-S. Vincent): Shells were collected in a fresh natural face exposed on the south side of a stream. *Mytilus* were found around a small boulder hence probably indicating little displacement.

UNITED STATES OF AMERICA

New York

Boyd Pond Series

A series of lake sediment samples from Boyd Pond, 23 km south-southeast of Canton, and 45 km southeast of Ogdensburg, New York (40°23.42'N, 75°5.58'W), at an elevation of 265 m, were collected by T.W. Anderson on August 18, 1981 in a water depth of 8.5 m; submitted by T.W. Anderson.

GSC-4543. Boyd Pond (I) — 2820 ± 70; $\delta^{13}C$= -28.8‰

The lake sediment, gyttja (sample AP-81-5C; 105-115 cm; 117.6 g wet weight), was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2290 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 2880 ± 70.

Comment (T.W. Anderson): The sample dates the beginning of the second *Tsuga* (hemlock) pollen peak.

GSC-4372. Boyd Pond (II) — 4320 ± 80; $\delta^{13}C$= -30.4‰

The lake sediment, gyttja (sample AP-5-81B; 204-214 cm; 127.2 g wet weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2110 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 4410 ± 80.

Comment (T.W. Anderson): The sample dates the mid-Holocene decline of *Tsuga* (Hemlock) pollen. The date is slightly younger than the regional estimate of 4.7 ka (Webb, 1982).

GSC-4555. Boyd Pond (III) 8000 ± 90
$\delta^{13}C$= -24.6‰

The lake sediment, gyttja (sample AP-81-5D; 445-455 cm; 157.1 g wet weight) was treated with hot acid (slightly calcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2380 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.00.

The uncorrected age is 7990 ± 90.

Comment (T.W. Anderson): The sample dates the first rise in the *Tsuga* (hemlock) pollen profile.

GSC-4236. Boyd Pond (IV) 9840 ± 140
$\delta^{13}C$= -28.9‰

The lake sediment, gyttja (sample AP-5-81A; 746.5-752.5 cm; 94.1 g wet weight) was treated with hot acid and distilled water rinses; base treatment was omitted. The age estimate is based on two counts for 2260 minutes (two 1 day) in the 2 L counter with a mixing ratio of 1.40.

The uncorrected age is 9910 ± 140.

Comment (T.W. Anderson): The date provides an age for the *Picea* (spruce) - *Pinus* (pine) pollen transition.

GSC-4369. Dodge Pond 12 900 ± 210
$\delta^{13}C$= -26.6‰

The lake sediment, gyttja (sample AP-86-15; 854-856 cm) was collected by T.W. Anderson on September 25, 1986 from Dodge Pond, about 2.0 km east-northeast of Fine, and 30 km southeast of Gouverneur, New York (44°15′15″N, 75°6′45″W) at an elevation of 296 m; submitted by T.W. Anderson.

The sample (38.2 g dry weight) was treated with hot acid (noncalcareous), and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.26.

The uncorrected age is 12 900 ± 210.

Comment (T.W. Anderson): The site lies about 7 km southeast of a northeast-southwest trending calcitic and dolomitic marble belt. Late Wisconsinan ice advanced in a southeast direction across the marble belt (D.L. Pair, pers. comm., 1989) incorporating carbonates into the interbedded grey clay and fine sand underlying the basal gyttja. The date occurs at the rise in *Picea* (spruce) pollen, which is dated at 11 200 ± 190 BP (GSC-3429, McNeely, 1989) at Boyd Pond located 15.5 km north of the site. The date is too old by about 1500 years because of the hardwater effect.

GSC-4370. Goose Pond 12 500 ± 140
$\delta^{13}C$= -22.1‰

The lake sediment, gyttja (sample AP-86-12; 551.5-553.5 cm) was collected by T.W. Anderson on September 20, 1986 from Goose Pond, about 4 km east of Harrisville, New York (44°7′30″N, 75°17′30″W) at an elevation of 262 m; submitted by T.W. Anderson.

The sample (79.9 g dry weight) was treated with hot acid (noncalcareous) and distilled water rinses; base treatment was omitted. The age estimate is based on one count for 4200 minutes (one 3 day) in the 2 L counter with a mixing ratio of 1.28.

The uncorrected age is 12 400 ± 140.

Comment (T.W. Anderson): The site lies about 3 km southeast of a northeast-southwest trending calcitic and dolomitic marble belt. Late Wisconsinan ice advanced in a southeast direction across the marble belt (D.L. Pair, pers. comm., 1989) incorporating carbonates into the sand underlying the basal gyttja. The date occurs at the rise in *Picea* (spruce) pollen, which is dated at 11 200 ± 190 BP (GSC-3429, McNeely, 1989) at Boyd Pond, 31 km northeast of the site. The date is too old by about 1000 years because of the hardwater effect.

Washington

GSC-3895. Georgia Strait 1340 ± 100
$\delta^{13}C$= -0.9‰

The marine shell (*Compsomyax subdiaphana*; identified by J.E. Dale) was enclosed in fine sandy mud. Sample VEC 83A-003 32-38 cm was collected by T.S. Hamilton and J. Luternauer in 1983 from southern Georgia Strait, north of Orcas Island and south of Matia Island, Washington, U.S.A. (48°43.7′N, 122°49.7′W), in a water depth of 67 m; submitted by T.S. Hamilton and J. Luternauer.

The sample (5.5 g dry weight) had no treatment. The age estimate is based on two counts for 2460 minutes (two 1 day) in the 2 L counter with a mixing ratio of 3.66.

The uncorrected age is 1360 ± 100.

Comment (T.S. Hamilton): The core penetrated a pond of the youngest sediments from the easternmost of a series of three cores. These muddy sands are locally reworked downslope by currents from slumped material and older (undated) glaciomarine diamicts. This sample helps to date the sparse postglacial sedimentation in southern Georgia Strait, south of the Fraser River (cf. T.S. Hamilton's coring cruise to assess the substrates of Georgia Strait).

DENMARK

Greenland

GSC-3674. Nyboe Land 6190 ± 100
$\delta^{13}C = -0.1‰$

The marine shells (*Astarte*; identified by J. England) were enclosed in marine silt and clay. Sample NL-3-S-82 was collected by J. England and D. Lemmon on July 20, 1982 from the outer coast of northwest Nyboe Land, in a valley about 10 km northeast of the mouth of Newman Bay, Greenland (82°2′N, 58°55′W), at an elevation of 35 m; submitted by J. England.

The sample (11.0 g dry weight) was treated with an acid leach to remove the outer 10% of the sample. The age estimate is based on one count for 4029 minutes (one 3 day) in the 2 L counter with a mixing ratio of 2.26.

The uncorrected age is 6190 ± 100.

GSC-3693. Hall Land 7740 ± 90
$\delta^{13}C = +0.8‰$

The marine shells (sample PPN-1-5-82; *Hiatella arctica*; identified by J. England) were collected by J. England on June 29, 1982 from west-central Hall Land, northwest Greenland (81°46′N, 59°27′W), at an elevation of 36.0 m; submitted by J. England.

The sample (48.0 g dry weight) was treated with an acid leach to remove the outer 20% of the sample. The age estimate is based on two counts for 5400 minutes (two 2 day) in the 5 L counter with a mixing ratio of 1.00.

The uncorrected age is 7730 ± 90.

GSC-3744. Hall Land 9580 ± 140
$\delta^{13}C = -0.6‰$

The marine shells (*Portlandia arctica*; identified by J. England) sample PP1-1S-82 were collected by J. England and D. Lemmen on July 23, 1982 from an exposure of marine silts approximately 1 km north of an unnamed tributary, east-central interior of Hall Land, northwest Greenland (81°42′20″N, 59° 36′W), at an elevation of 110 m; submitted by J. England.

The sample (17.3 g dry weight) was treated with an acid leach to remove the outer ten per cent of the sample. The age estimate is based on two counts for 2170 minutes (two 1-day) in the 2 L counter with a mixing ratio of 1.31.

The uncorrected age is 9590 ± 140.

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HP- 'High Pressure' (5L counter at 4 atmospheres)

OF- 'outer fraction' (approximately 50%) of shell sample
IF- 'inner fraction' (approximately 50%) of shell sample

BE- 'base extract'

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-3899	89	-4028	75	-4104	83	-4168	53
-3900	23	-4029	76	-4105	100	-4171	41
-3907 OF	49	-4030	75	-4106	93	-4172	42
-3907 IF	49	-4031	110	-4107	11	-4173	55
-3908	79	-4032	92	-4108	76	-4175	20
-3912	23	-4033	112	-4109	74	-4176	100
-3917	71	-4035	83	-4111	83	-4177	62
-3919	68	-4036	65	-4114	121	-4178	82
-3927	67	-4037	65	-4115	77	-4179	55
-3931	85	-4038	106	-4116	73	-4180	92
-3933	42	-4040	78	-4117	70	-4181	67
-3934	92	-4041	65	-4118	93	-4182	9
-3936	114	-4042	29	-4120	77	-4183	11
-3938	57	-4043	48	-4121	93	-4185	42
-3942	87	-4044	48	-4122	10	-4186	10
-3945	113	-4045	110	-4124	64	-4187	105
-3947	40	-4046	63	-4127	117	-4189	21
-3950	21	-4049	109	-4128	83	-4190	82
-3958	22	-4050	63	-4129	73	-4191	75
-3959	99	-4051	119	-4131	10	-4192	13
-3962	114	-4052	51	-4132	46	-4193	120
-3963	29	-4053	31	-4133	45	-4194	69
-3967	109	-4054	63	-4134	120	-4195	88
-3969	78	-4055	31	-4135	82	-4196	44
-3972	77	-4056	52	-4136	73	-4197	93
-3975	112	-4058	91	-4137	74	-4198	92
-3976	87	-4059	54	-4138	59	-4199	31
-3977	113	-4061	63	-4139	59	-4201	53
-3979	77	-4068	91	-4140	92	-4202	120
-3981	28	-4069	117	-4141	54	-4203	123
-3983 OF	49	-4070 OF	50	-4144	82	-4204 OF	21
-3983 IF	49	-4070 IF	50	-4145	92	-4204 IF	21
-3984	87	-4076	74	-4146	54	-4206	120
-3985	109	-4078	54	-4148	10	-4207	71
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-4211	71	-4278	32	-4349	97	-4415	68
-4212	82	-4280	43	-4350	50	-4417	111
-4213	52	-4281	17	-4351	97	-4419 HP	25
-4215	42	-4282	43	-4352	57	-4420 HP	59
-4216	92	-4283	20	-4354	58	-4421	61
-4217	55	-4284	62	-4355	64	-4422	61
-4218	61	-4286	80	-4356	119	-4423 HP	54
-4219	92	-4287	119	-4357	99	-4424	94
-4220	61	-4289	80	-4358	40	-4425	94
-4223	72	-4290	72	-4359	49	-4427	111
-4226	69	-4293	122	-4361	115	-4428	111
-4227	110	-4294	118	-4362	97	-4434	29
-4228	46	-4296	119	-4363	65	-4436 HP	86
-4230	24	-4297	27	-4364	69	-4442	109
-4231	11	-4298	71	-4366	98	-4447	106
-4233	101	-4299	117	-4367	25	-4456	107
-4234	118	-4301	80	-4368	95	-4457	107
-4235	47	-4302	73	-4369	125	-4458	107
-4236	125	-4305	80	-4370	125	-4459	107
-4237	67	-4307	70	-4371	57	-4468	47
-4238	69	-4313	117	-4372	124	-4469	104
-4239	72	-4315	47	-4373	104	-4474	25
-4240	43	-4316	118	-4374	95	-4475	24
-4241	111	-4317	99	-4375	97	-4477	47
-4242	117	-4318	96	-4376	105	-4478	114
-4244	88	-4319	40	-4377	116	-4479	115
-4246	24	-4321	33	-4379	99	-4486	94
-4249	104	-4322	116	-4380	40	-4487 HP	22
-4250	109	-4325	59	-4381	15	-4491 HP	57
-4251	45	-4326	41	-4382	26	-4493	32
-4252	39	-4327	9	-4383	66	-4495	94
-4253	14	-4328	27	-4384	104	-4500	39
-4254	118	-4329	97	-4386	104	-4501	39
-4255	69	-4330	39	-4387	115	-4503	107
-4256	43	-4331	118	-4388	26	-4504	122
-4258	46	-4332	101	-4390	95	-4508 OF	44
-4260	96	-4333	19	-4391	16	-4508 IF	44
-4260 2	96	-4333 BE	19	-4392	99	-4511	102
-4261	31	-4334	64	-4393	15	-4515	108
-4262	119	-4335	41	-4394	26	-4518	44
-4264	72	-4336	116	-4395	105	-4519	123
-4265	27	-4337	28	-4396	68	-4523	108
-4266	60	-4338	118	-4398	114	-4524	108
-4267	27	-4339	95	-4400	17	-4525	112
-4269	119	-4340	15	-4402	94	-4526	14
-4273	60	-4341	39	-4404	59	-4527	113
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